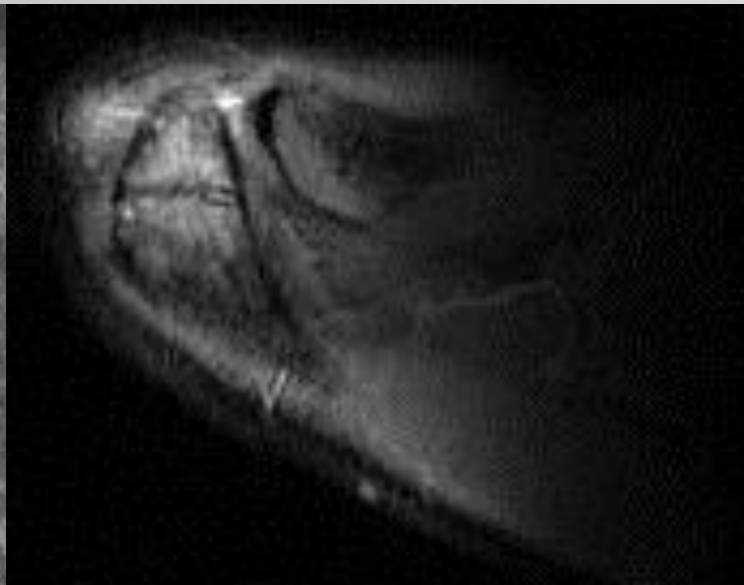
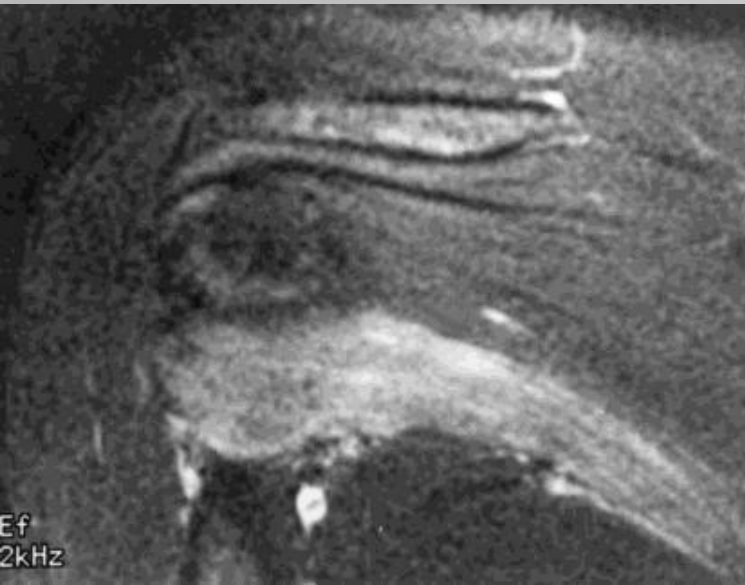
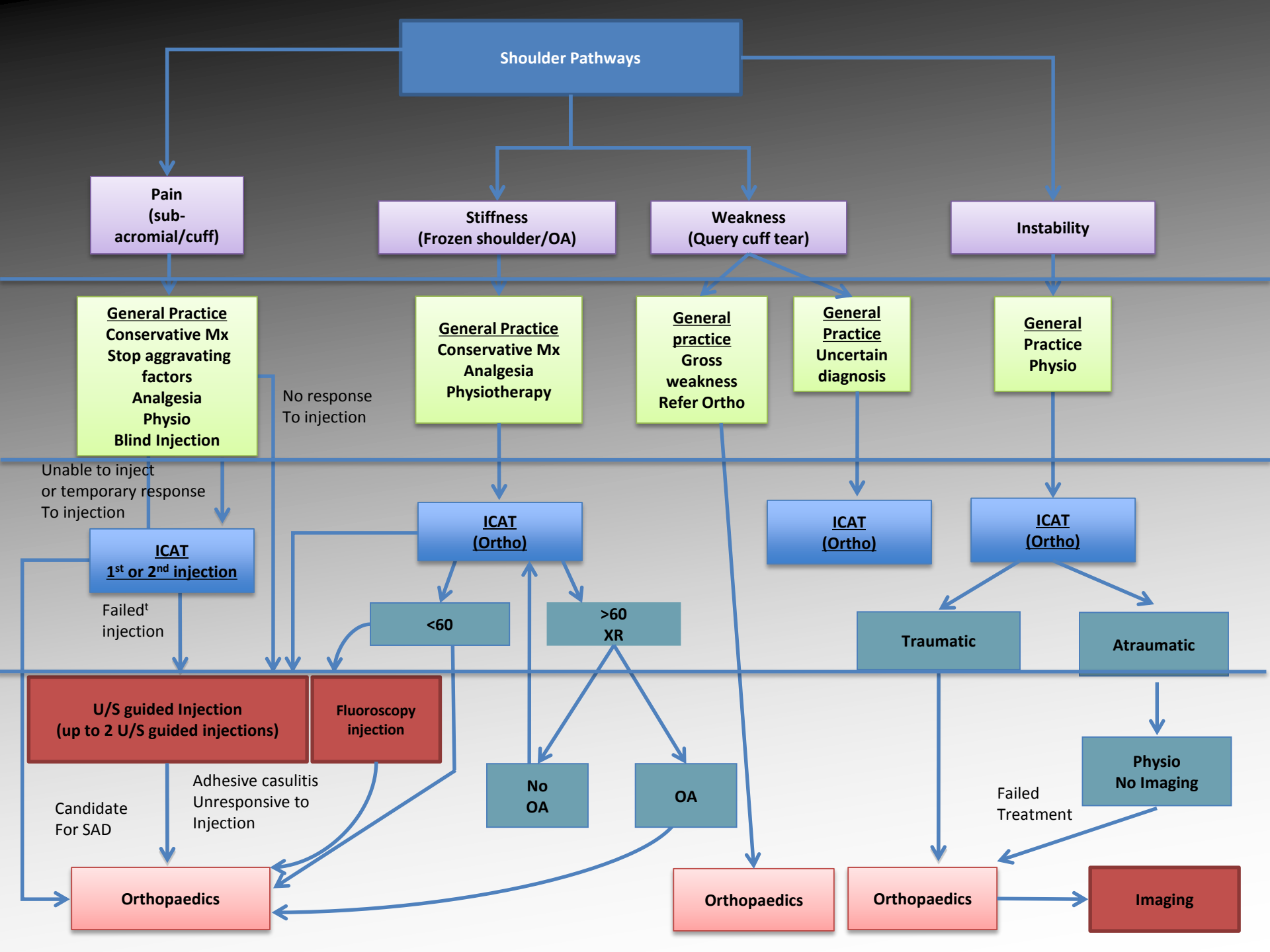


MRI shoulder: troubleshooting the cuff and instability

Phil Hughes
Plymouth





Shoulder Pathways

Pain
(sub-
acromial/cuff)

General Practice
Conservative Mx
Stop aggravating
factors
Analgesia
Physio
Blind Injection

No response
To injection

Unable to inject
or temporary response
To injection

ICAT
1st or 2nd injection

Failed^t
injection

U/S guided Injection
(up to 2 U/S guided injections)

Candidate
For SAD

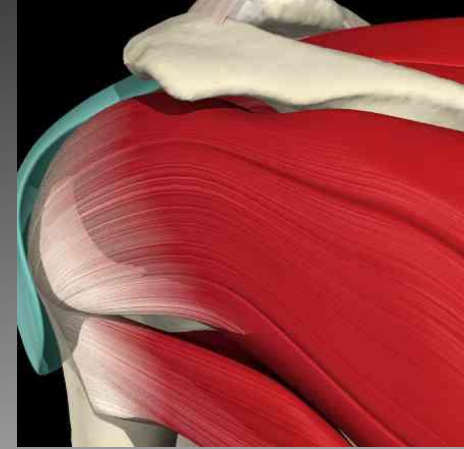
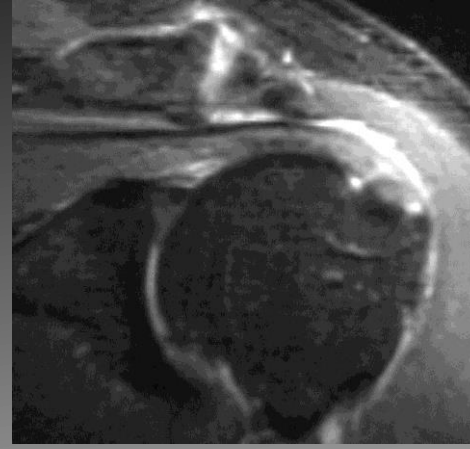
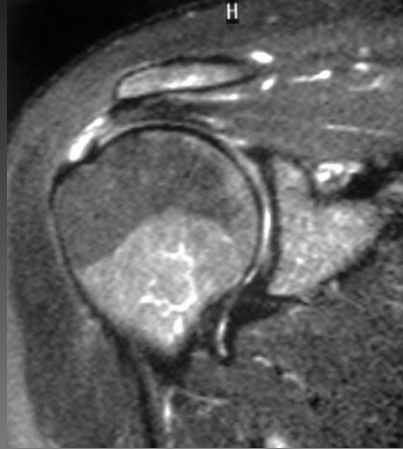
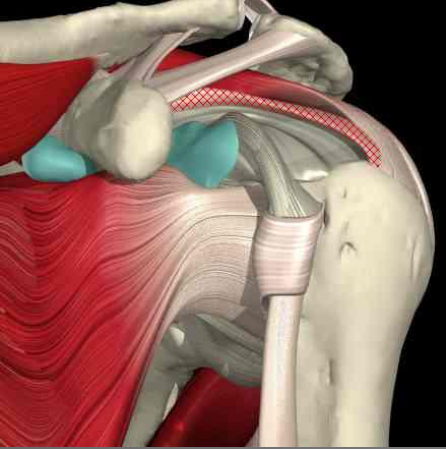
Adhesive casulitis
Unresponsive to
Injection

Orthopaedics

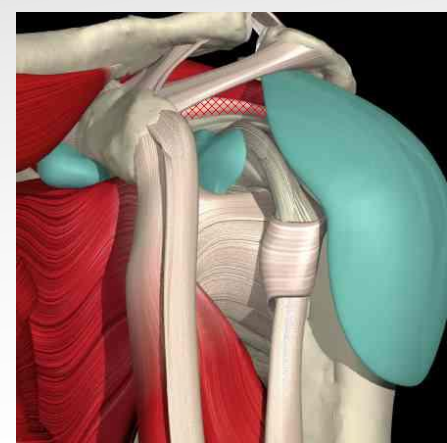
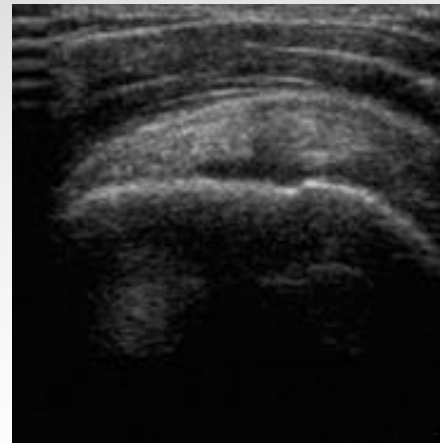
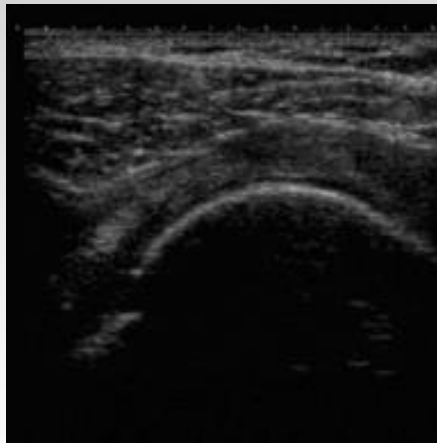
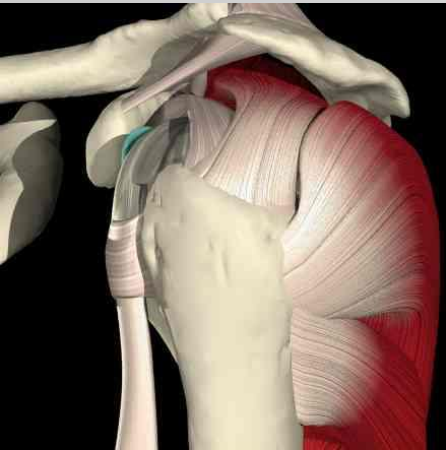
Diagnostic US

Primary Imaging Modalities

- Ultrasound MSI
- Plain films & US: Pre-op
- MRI: Problem solving



Rotator Cuff



Rotator Cuff Tears

Does MR have an Advantage ?

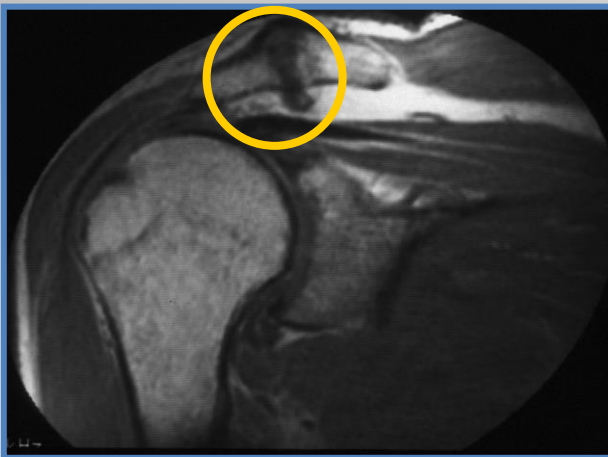
A



C



B

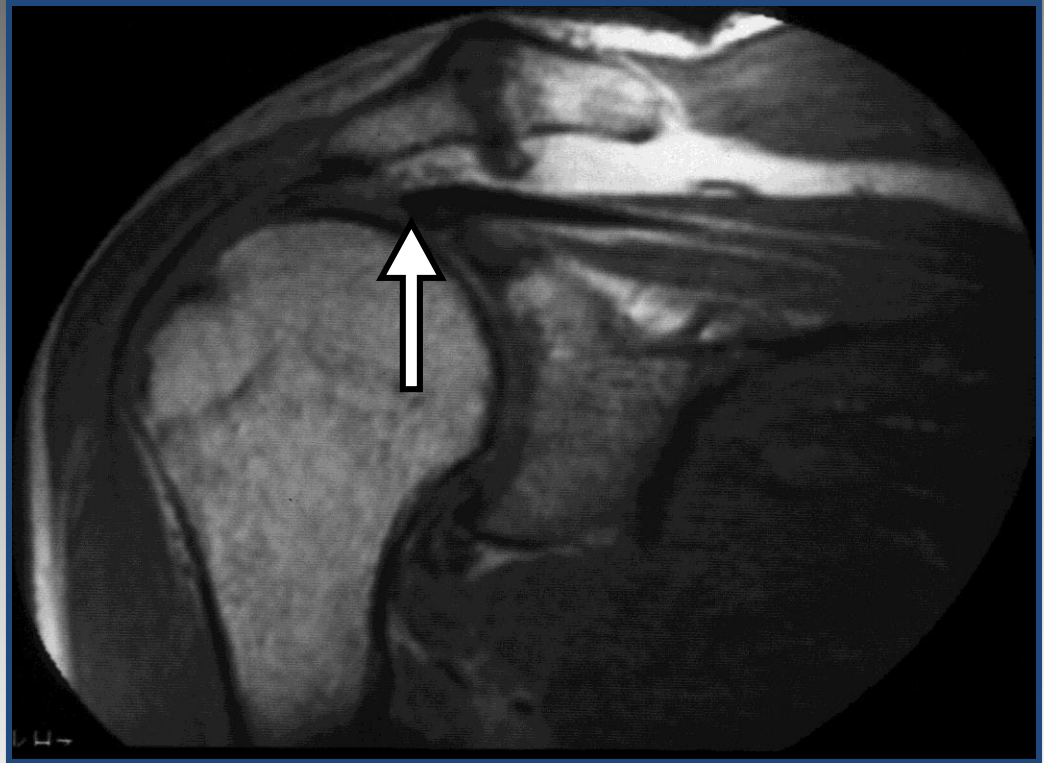
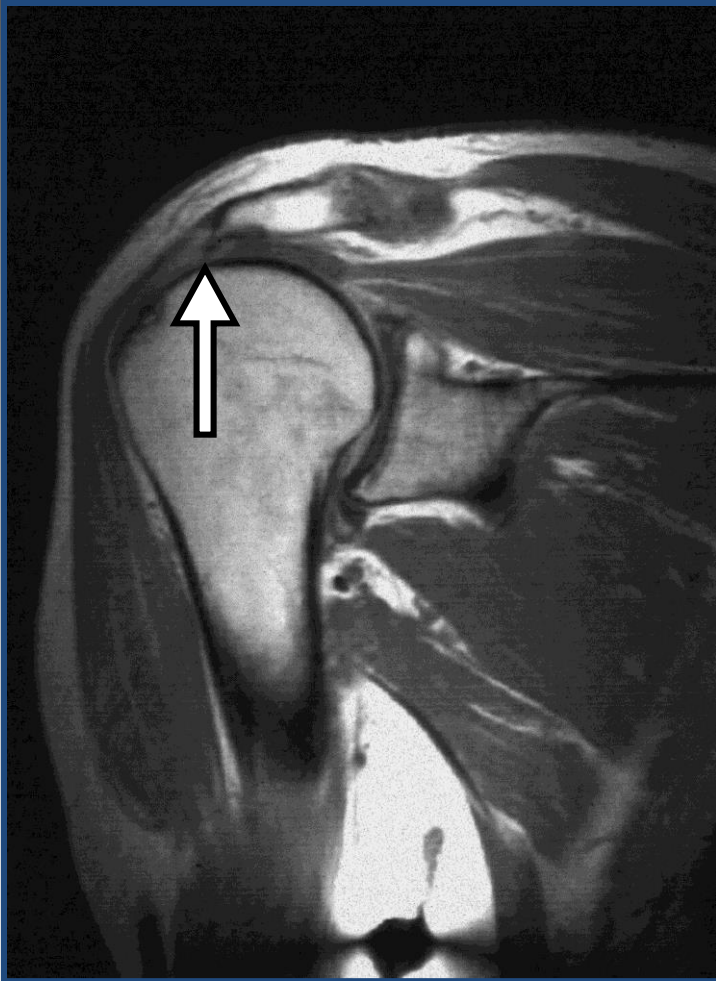


D



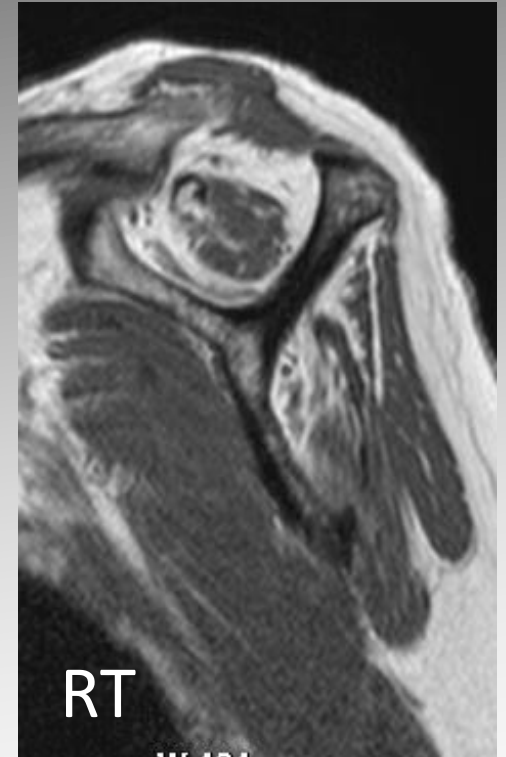
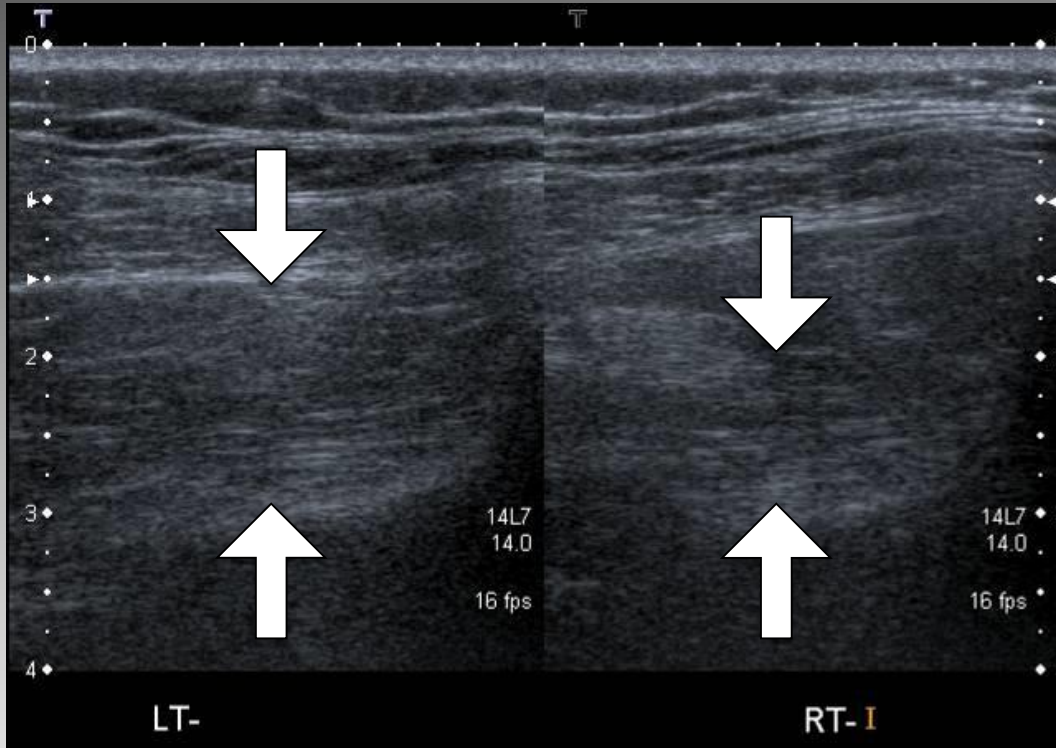
Rotator Cuff Tears

Full Thickness: Poor prognostic signs



- Medial Retraction
- Muscle Atrophy

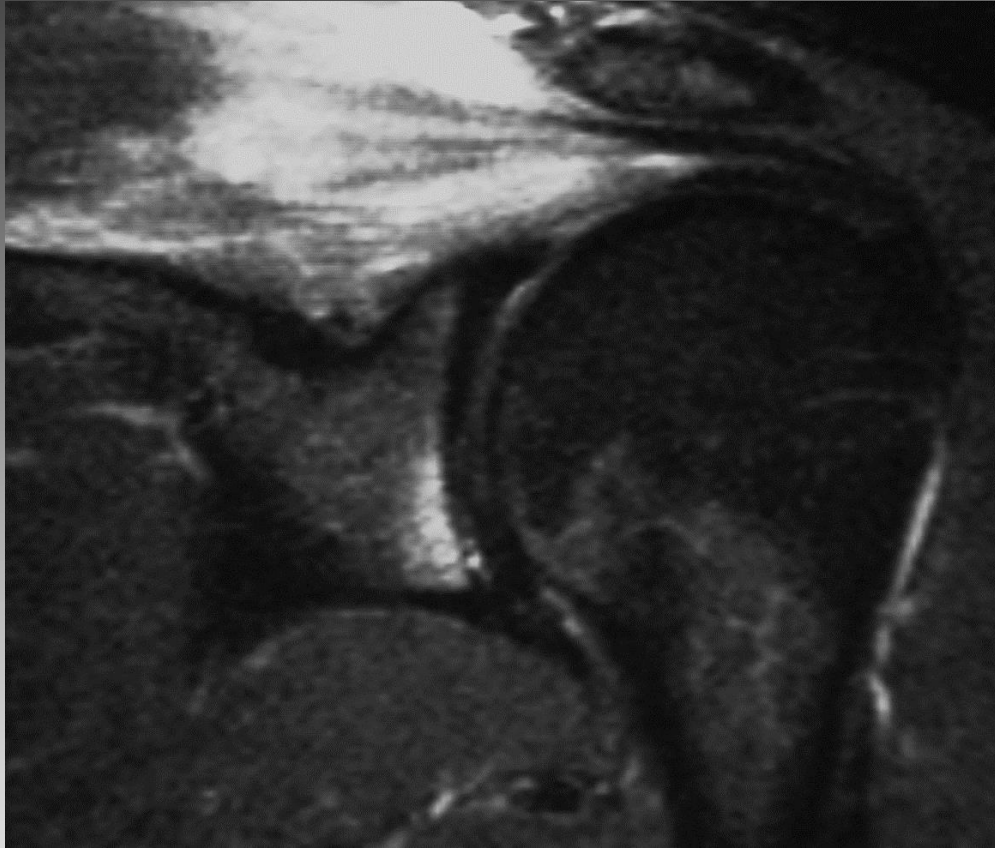
Muscle Atrophy US v MRI



Strobel. US in fatty atrophy of cuff muscles (2003)
Accuracy 76 - 80% for grade 2 - 4

Rotator Cuff Injury

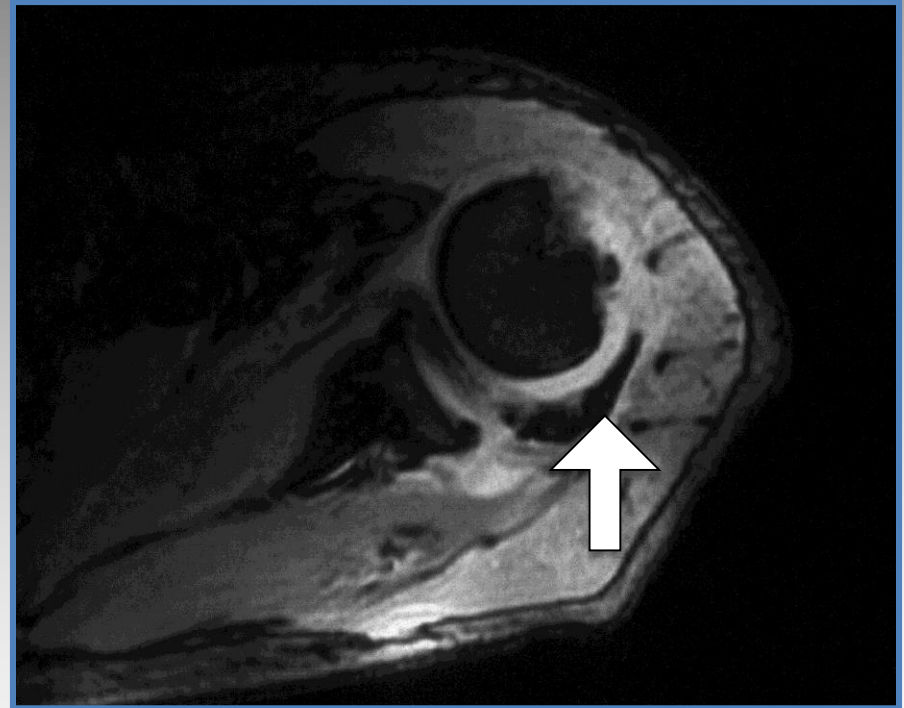
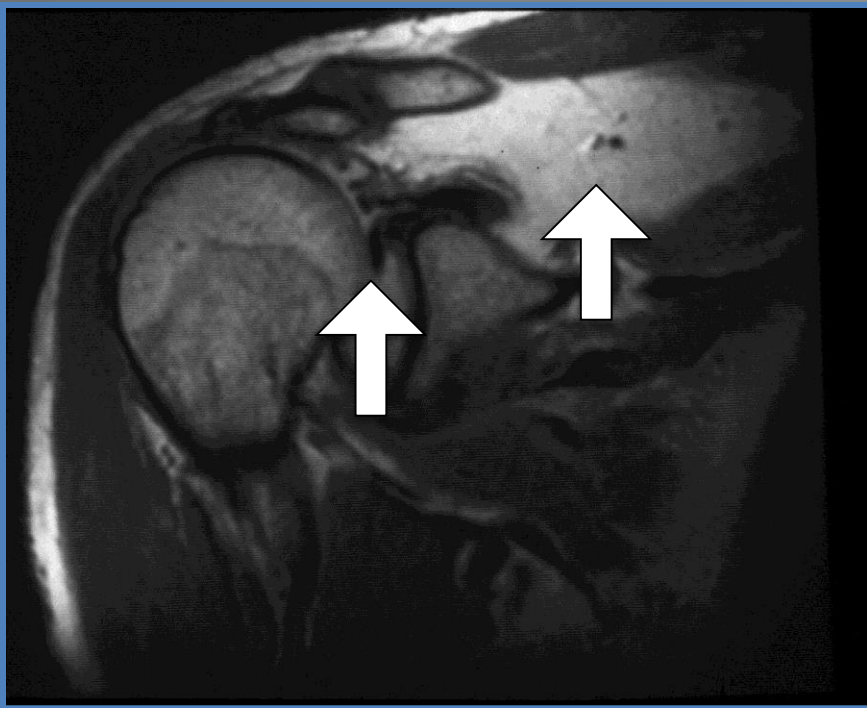
Acute



- MRI preferable
- High performance individuals
- Professionals
- Normal US → MRI

Rotator Cuff Tears

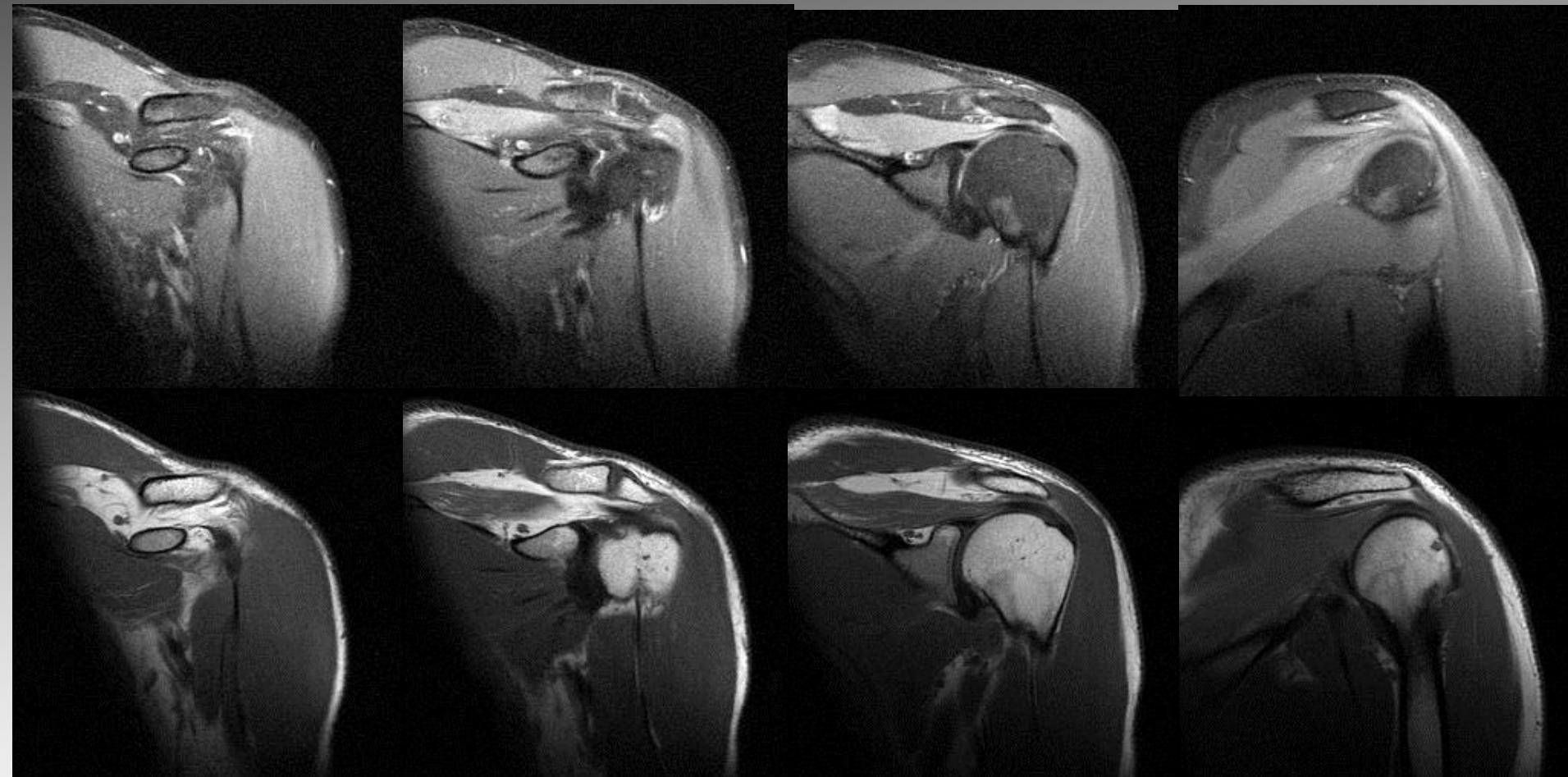
Humeral head Stand-off



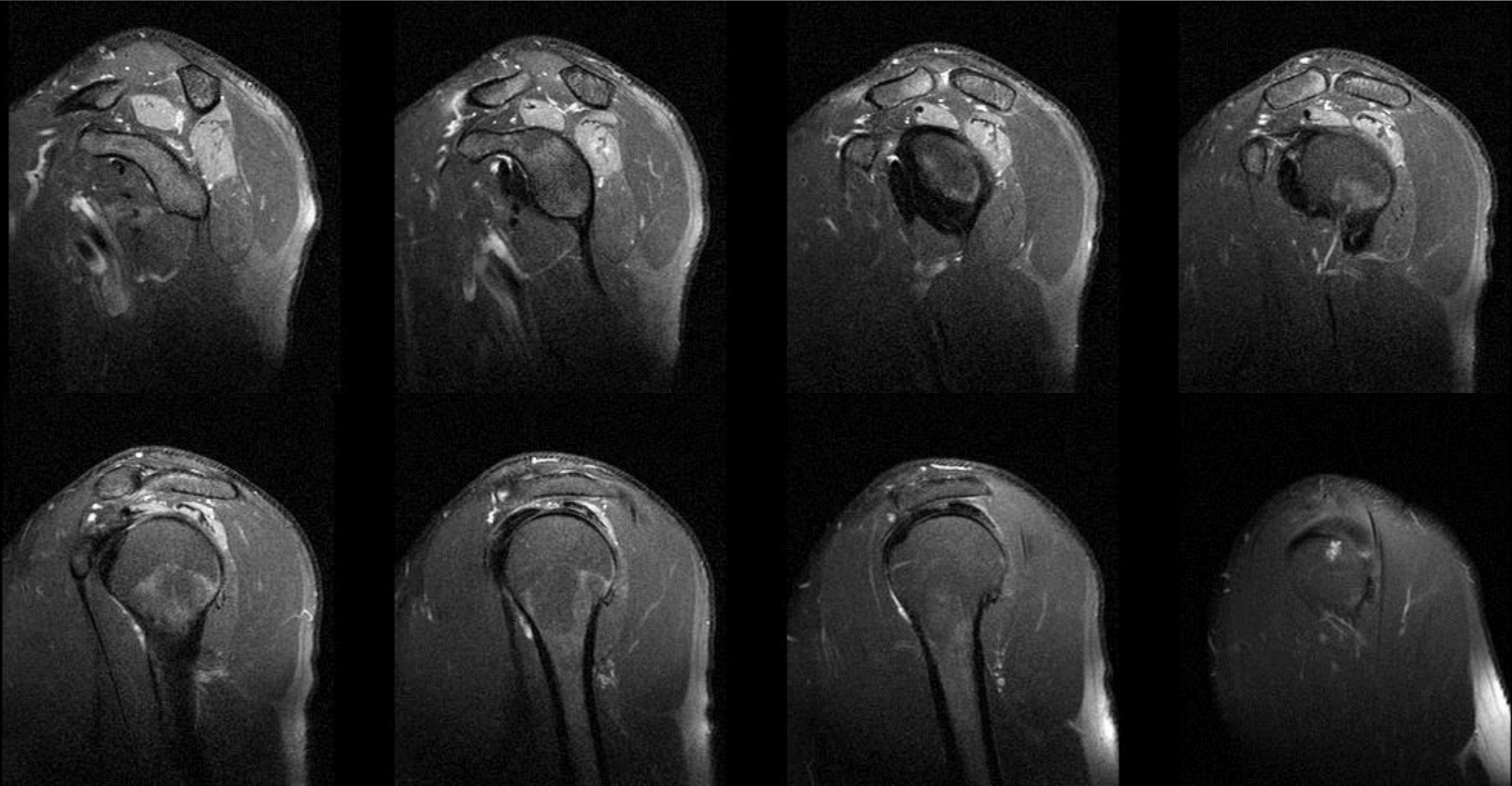
Case 1: 26 year old Policeman presented to ED following RTA: Driver in pursuit collision

- Severe Shoulder pain
 - Weakness in abduction
 - Immediate onset
 - Failure to resolve over weeks
 - Shoulder X-Ray Normal
-
- Provision Diagnosis
 - Rotator cuff Injury

Coronal STIR and Proton Density Images



Sagittal STIR Images



Based on the MRI Imaging Most Likely Diagnosis?

1. Tendonopathy
2. Tear
3. Contusion
4. Neuropraxia
5. Quadrilateral Space Syndrome

Based on the MRI Imaging Most Likely Diagnosis?

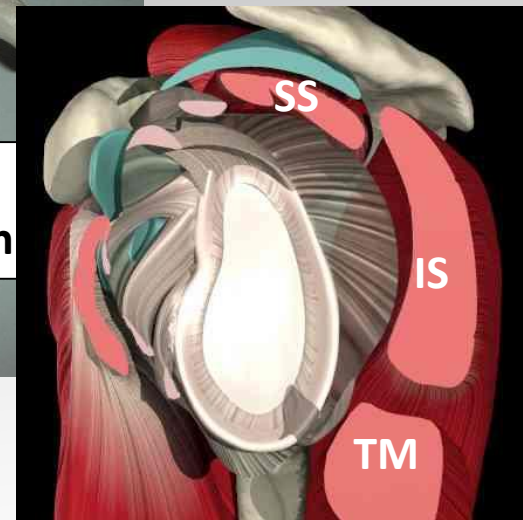
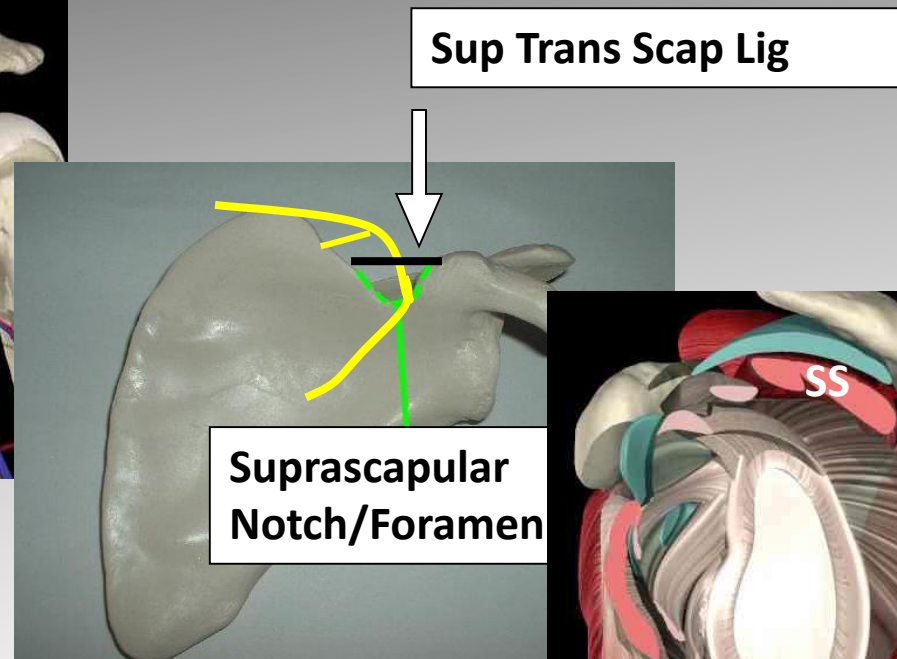
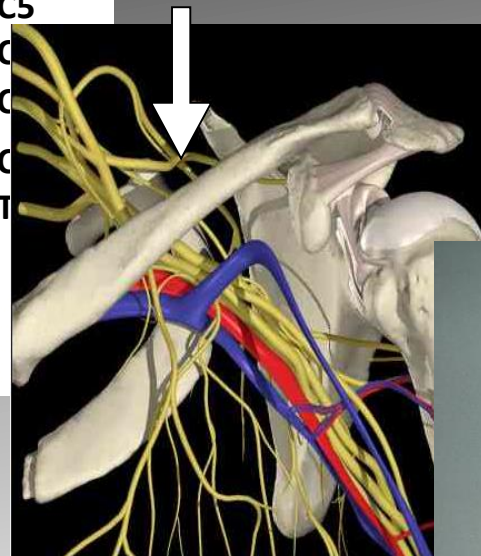
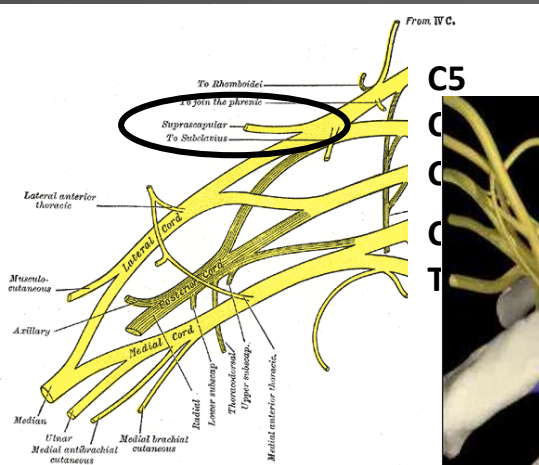
1. Tendonopathy
2. Tear
3. Contusion
4. **Neuropraxia**
5. Quadrilateral Space Syndrome



Diagnosis:
Suprascapular Neuropraxia

Differential: C5 and/or C6 Nerve Injury

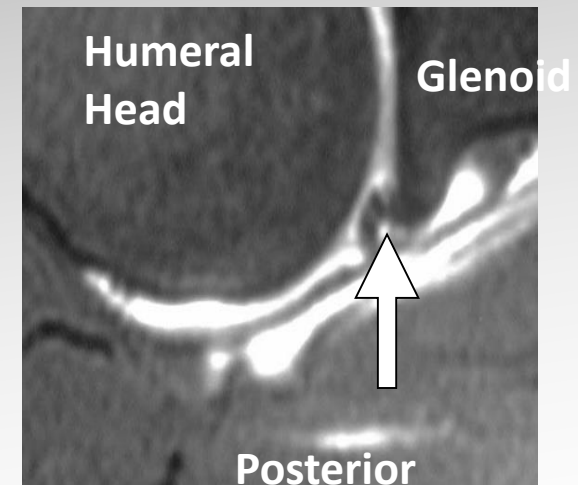
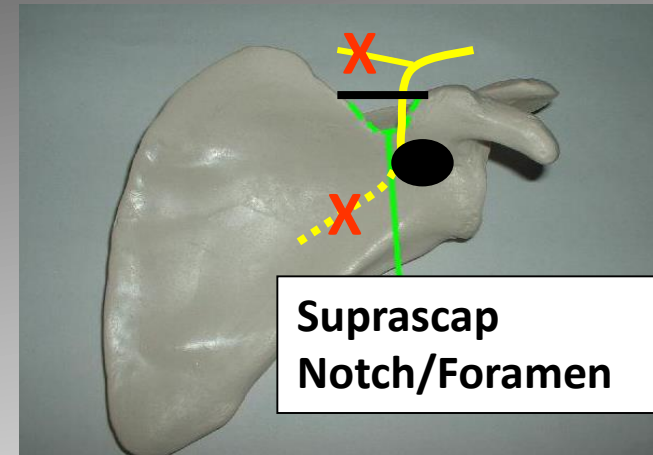
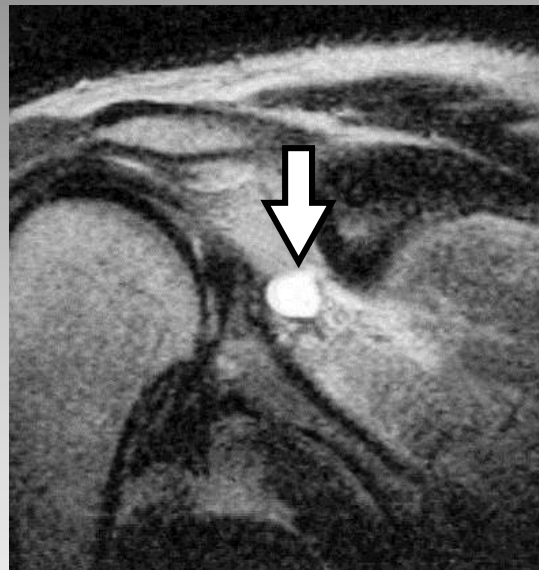
Muscle Denervation: Shoulder Suprascapular Nerve Compression



Infrascapular Nerve Compression



Spinoglenoid
notch cyst

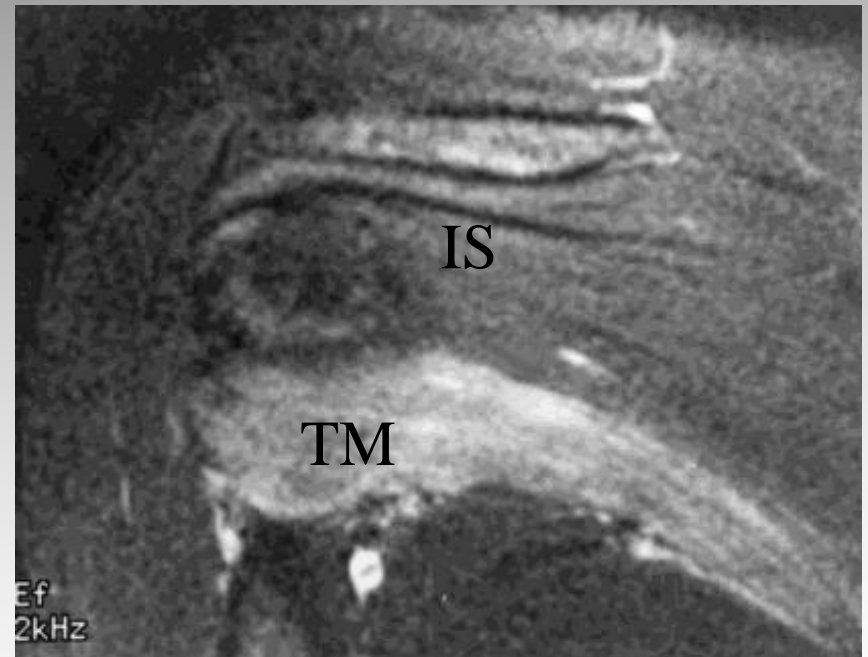
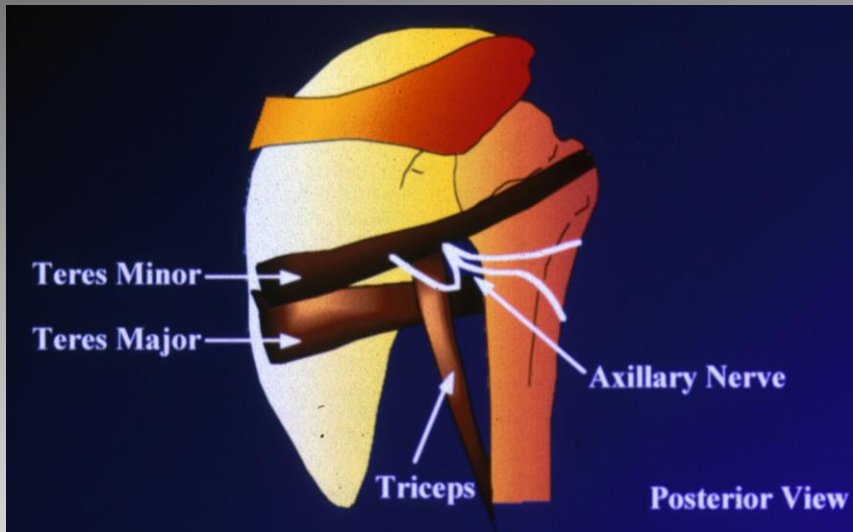


Differential

- ◆ Varix
- ◆ Stenosis at Foramen
- ◆ Trauma

Muscle Denervation

Quadrilateral Space Syndrome



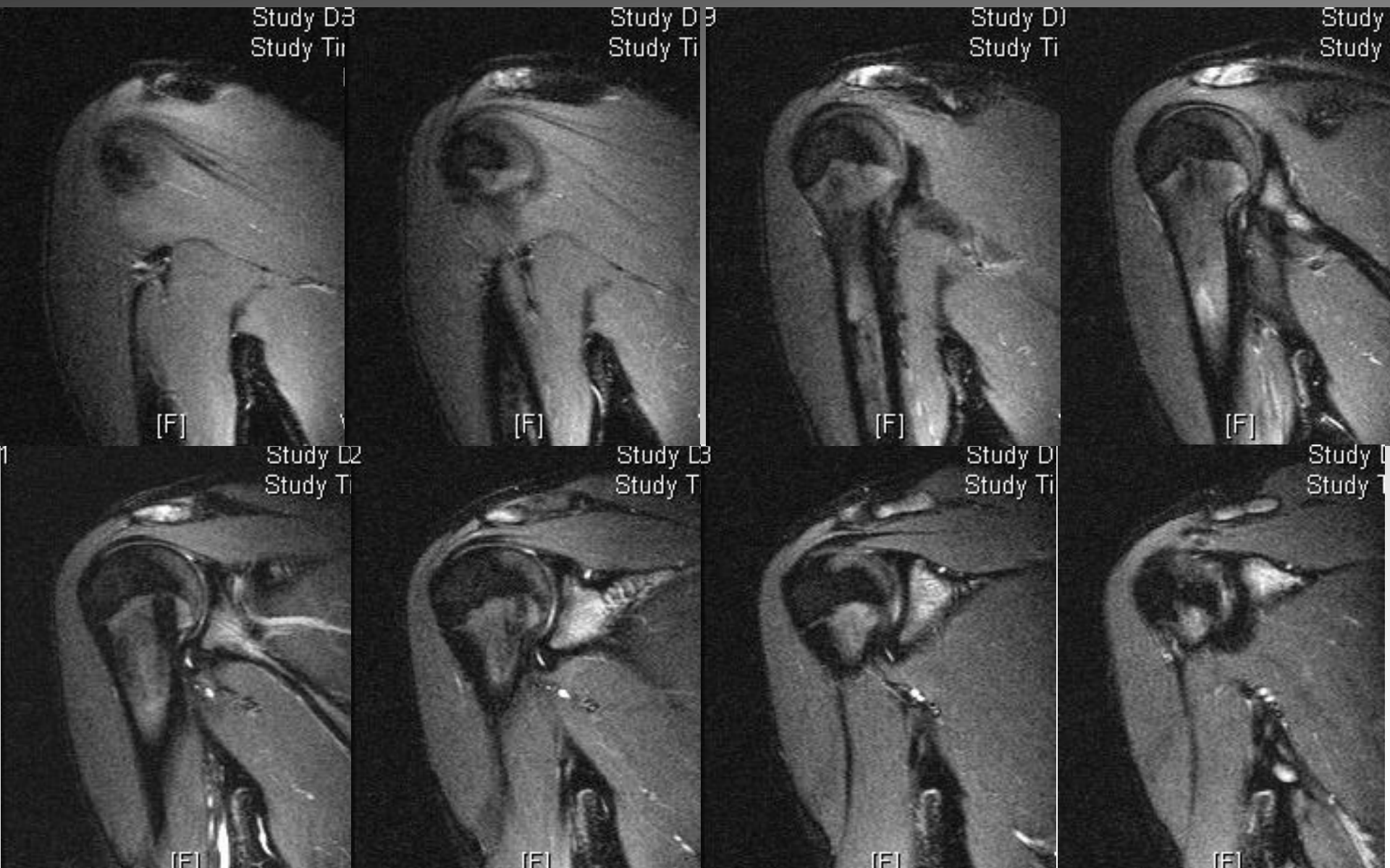


Case 2: 18 year old International High Board Diver

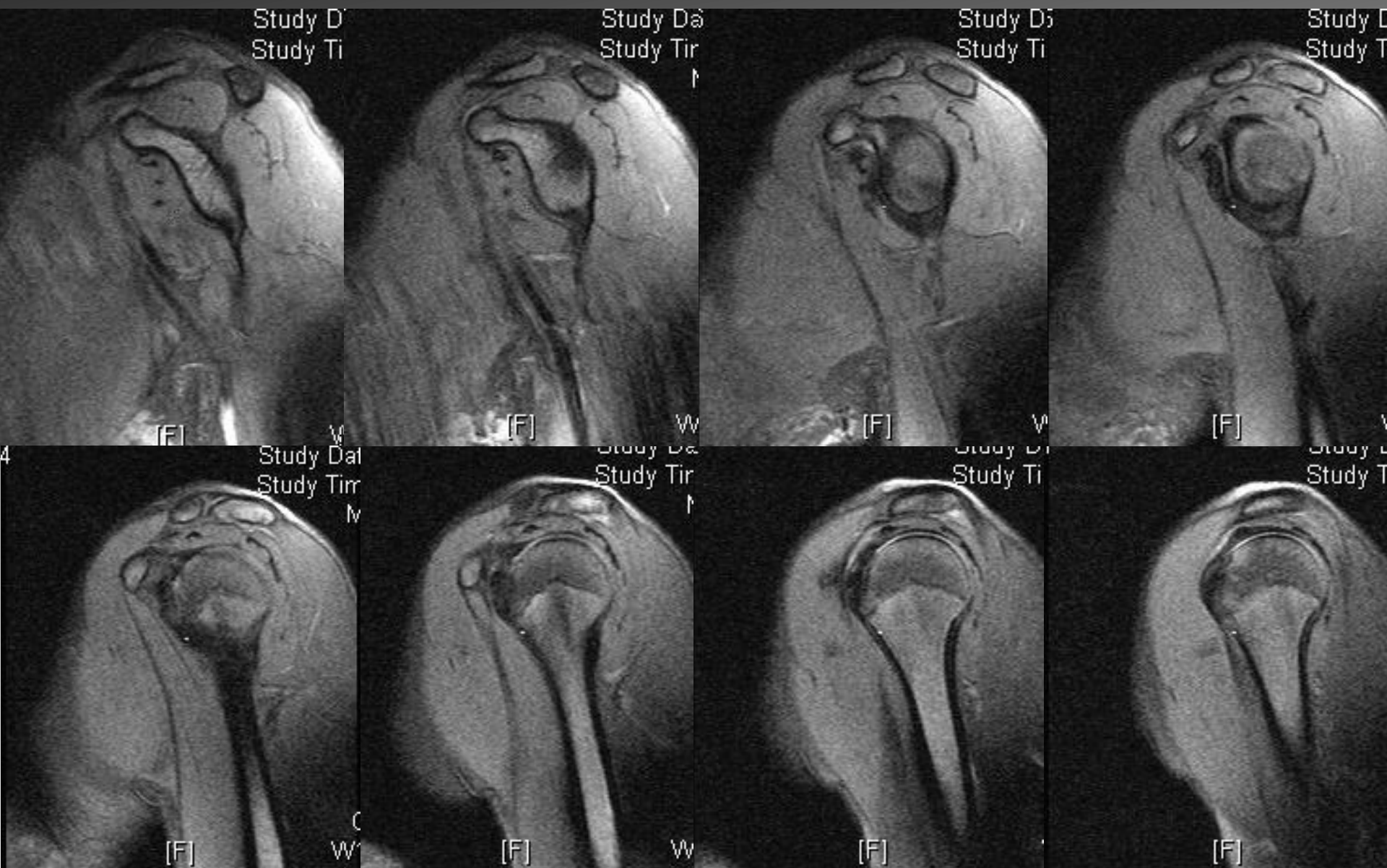
- 6 month history of shoulder pain
- Pain on flexion-abduction
- Nocturnal pain
- Recurrent



Coronal STIR Images

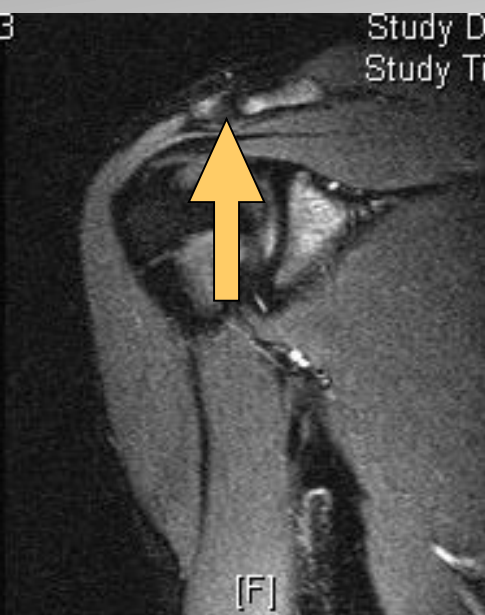
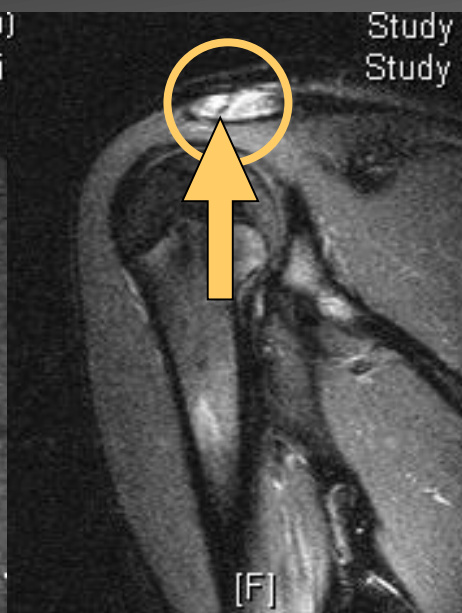
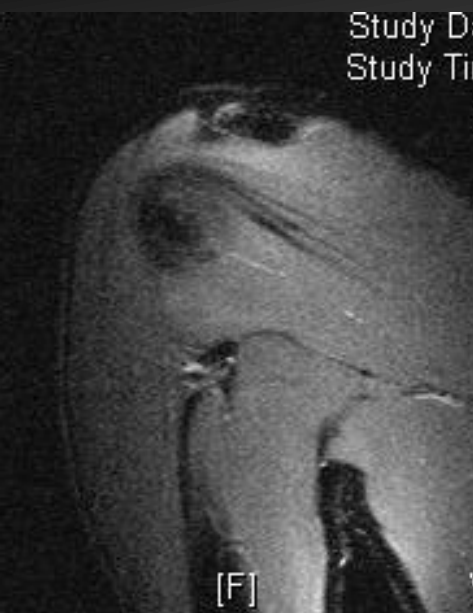


Sagittal Proton Density + Fat Suppression



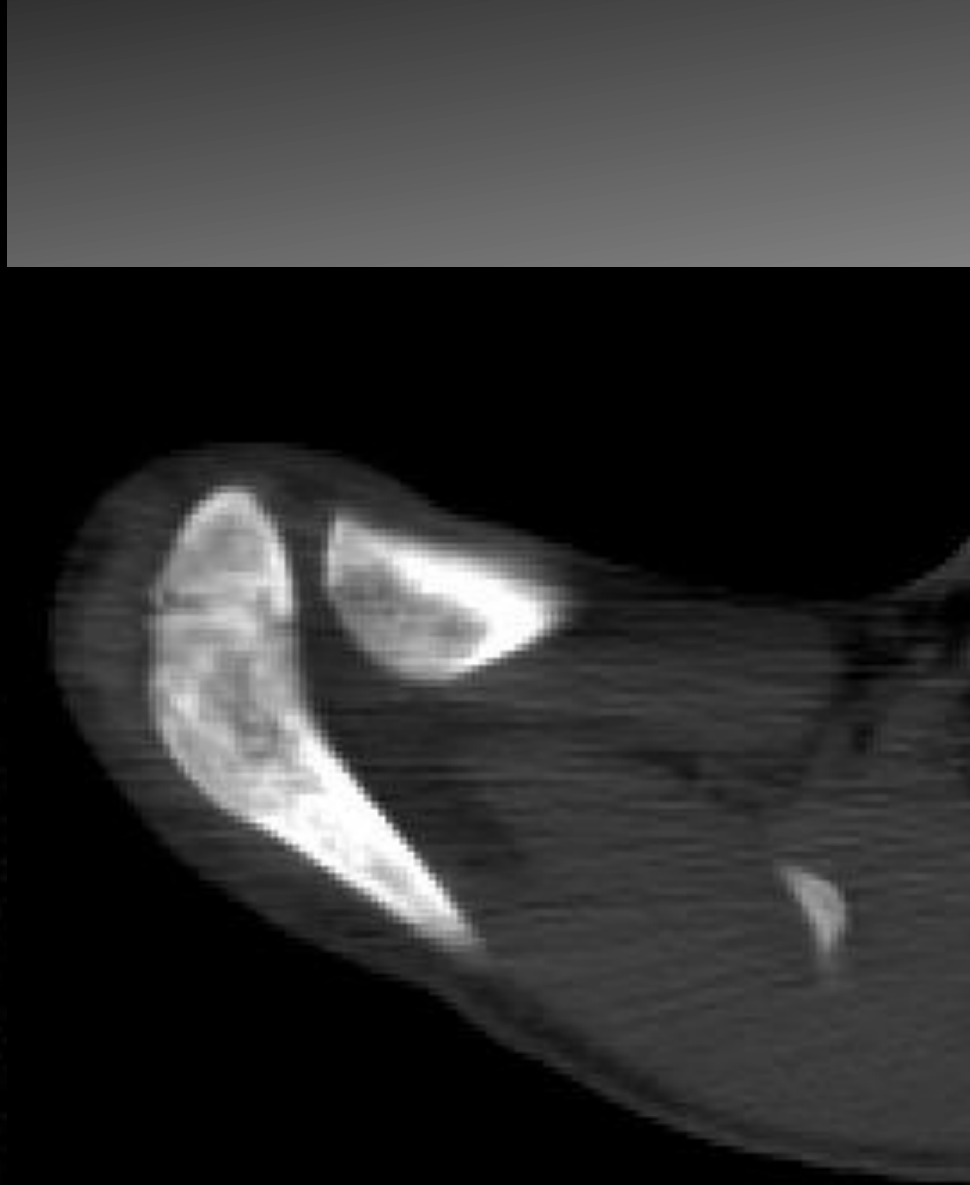
Select the most likely diagnosis based on the MRI ?

1. Bursitis
2. Tendonopathy
3. Tear
4. Os Acromiale
5. Superior labral tear anterior to posterior (SLAP)

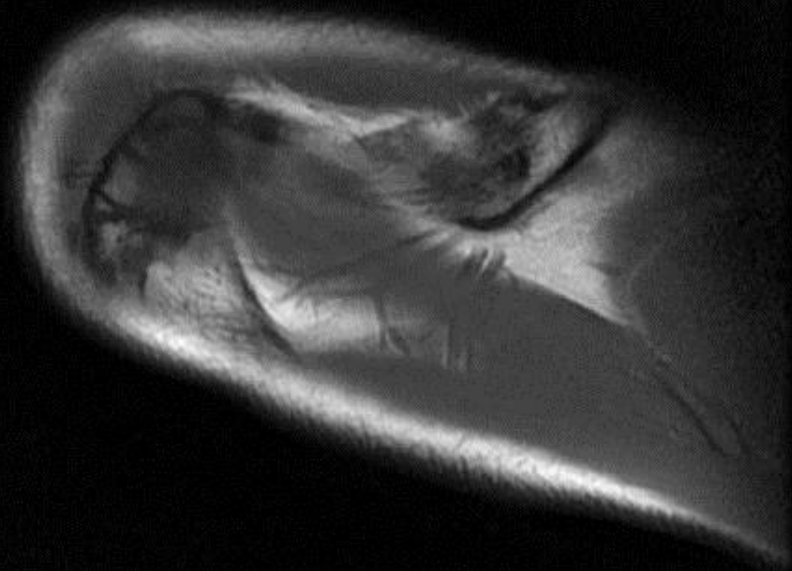
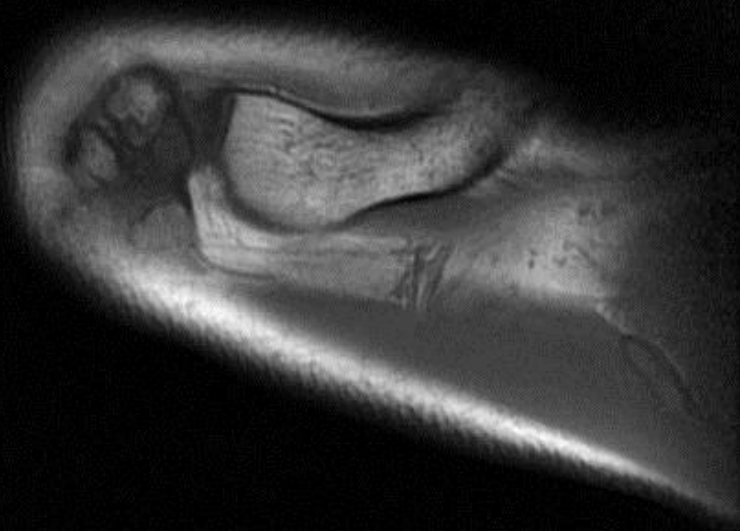




2006 Jan



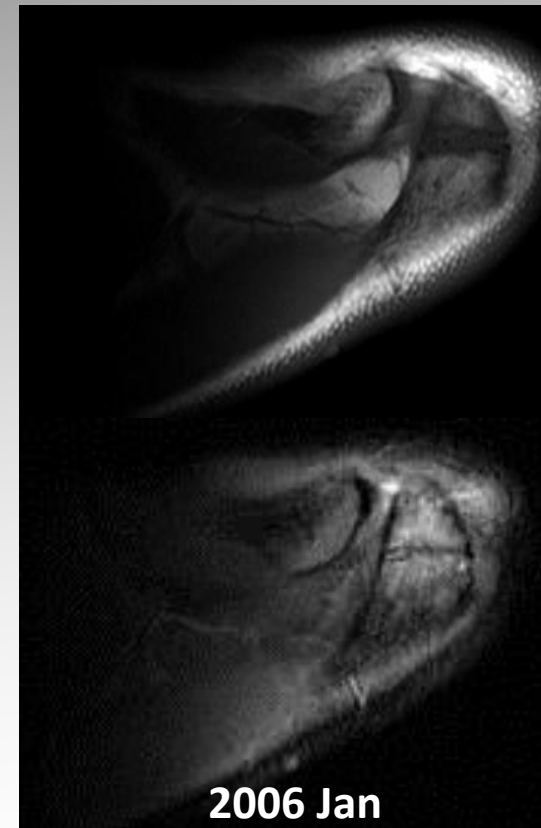
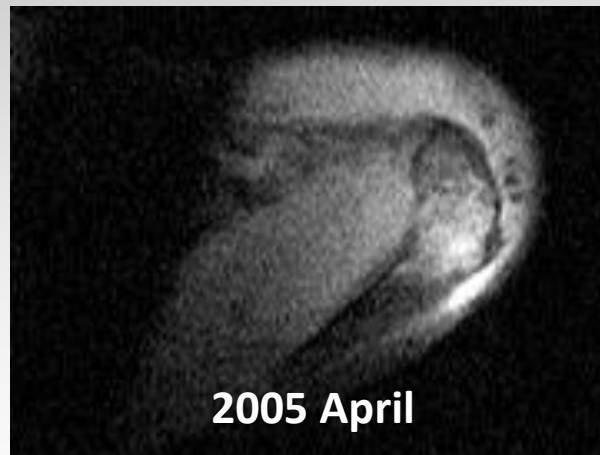
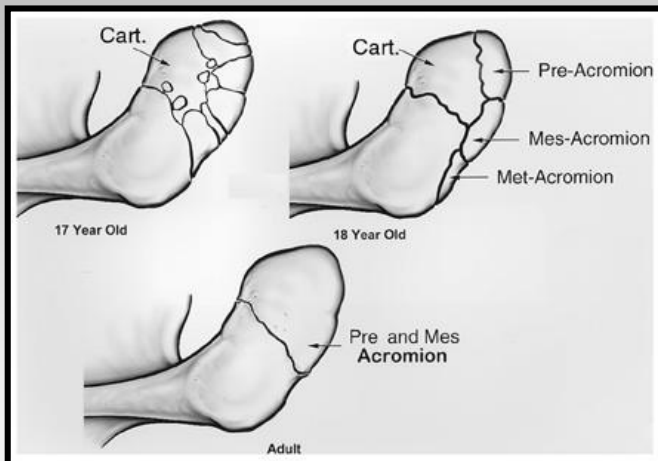
Os Acromiale Normal Appearances



Os Acromiale

- Incidence 1-15%
- Cadaveric 8% (33% Bilateral)
- Black:White 2:1

Sammarco et al, JBJS, 2000





Case 3: 34 year old Royal Marine suffering multiple anterior shoulder dislocation

- First dislocation 3 years previous
- Now constantly apprehensive
- Downgraded
- No weakness

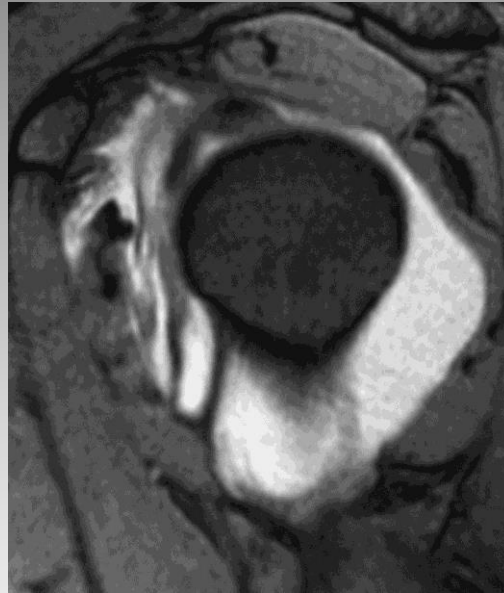
Investigating Instability

Shoulder MR Arthrography v MR

Advantages

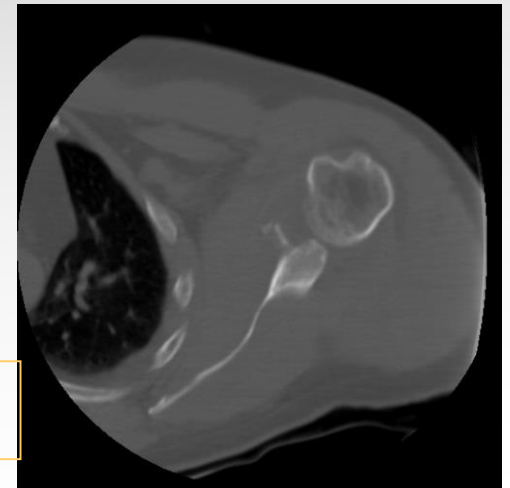
Spatial resolution

- Labral tears
- GHJs
- Rotator interval
- *Partial RCTs*
- *Loose bodies*



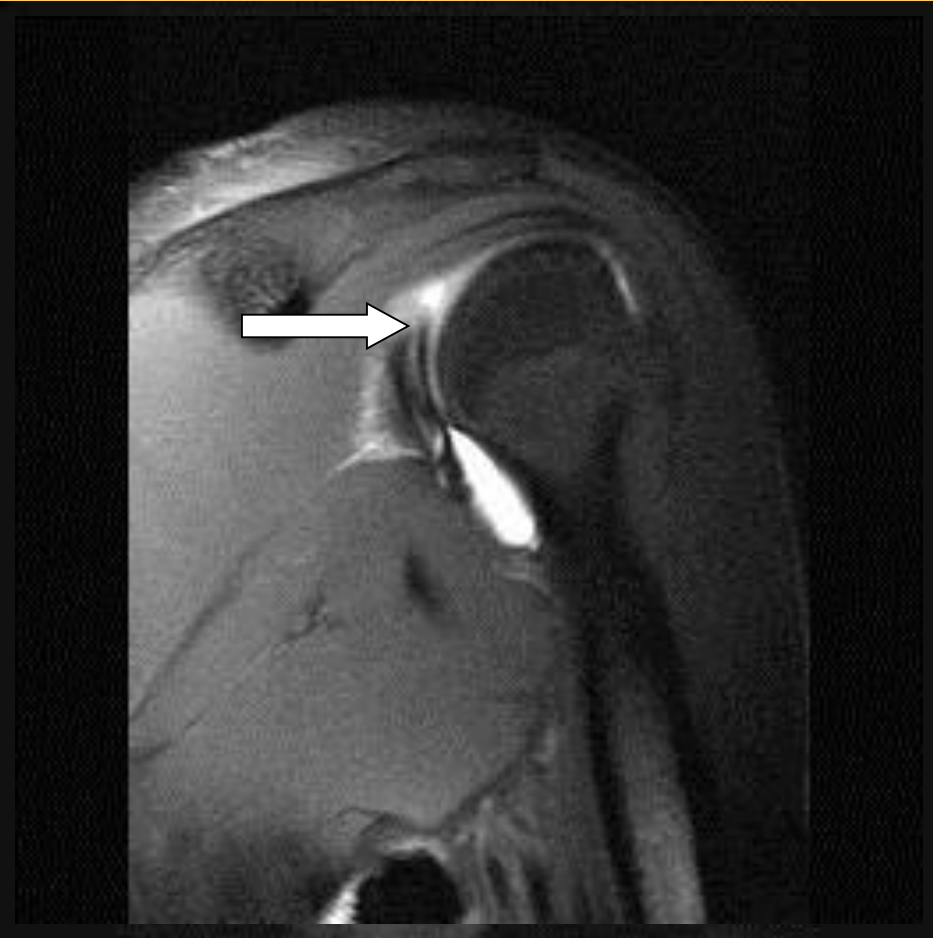
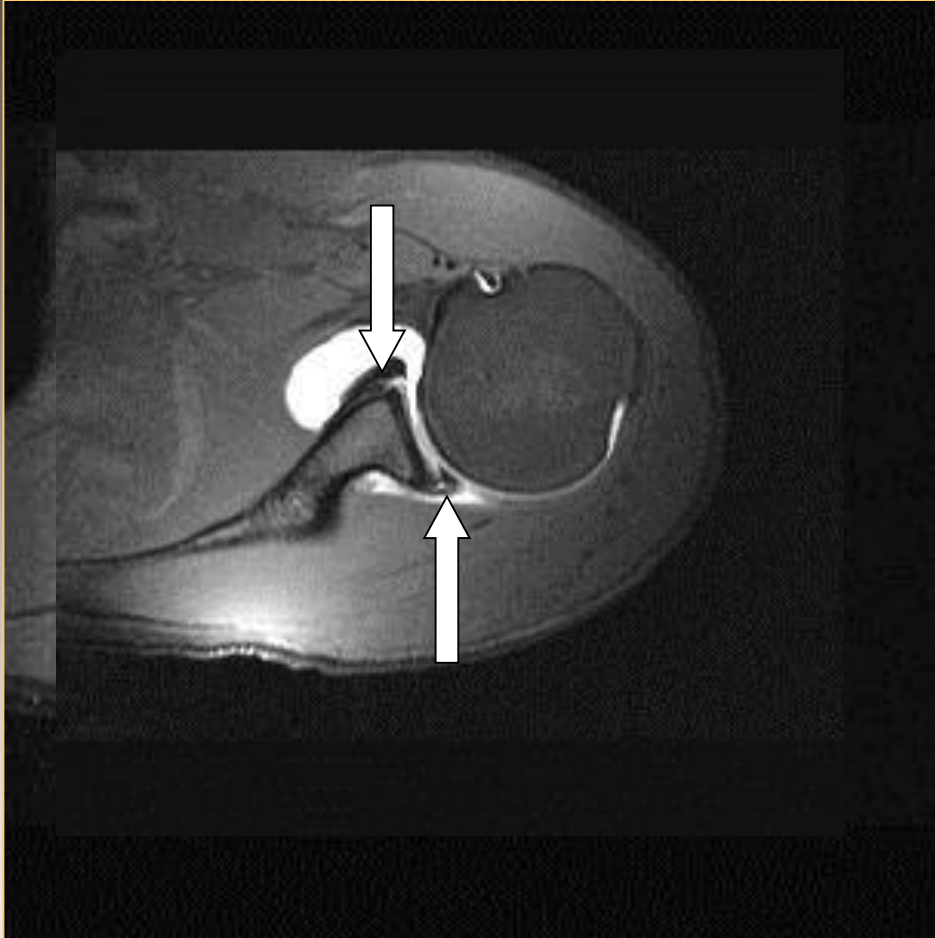
Limitations

- Invasive
- Fluoroscopy
- Ultrasound

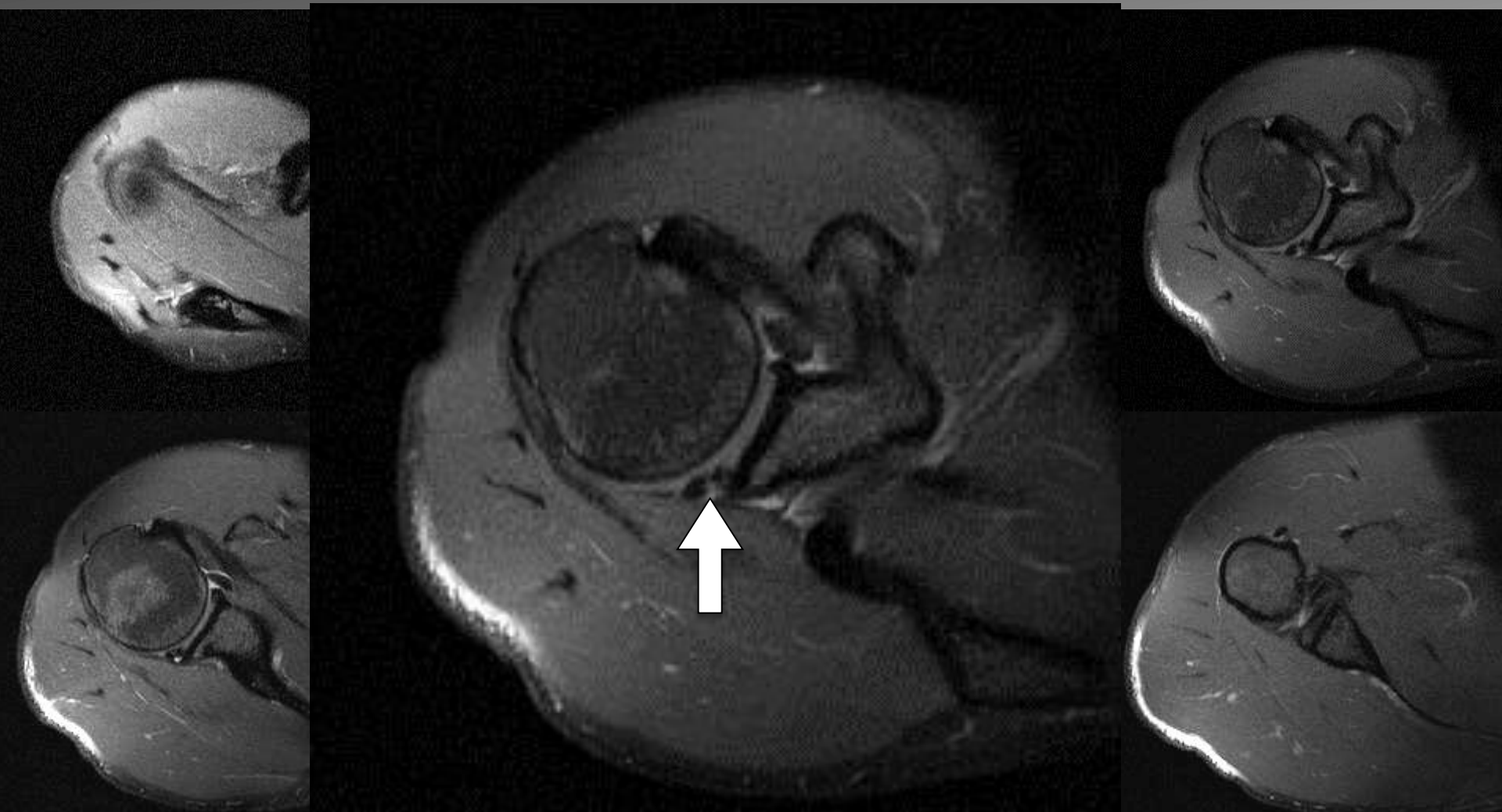


Understand Surgical Requirements

MR Arthrogram: T1-SE + FS



Axial Proton Density with Fat Suppression

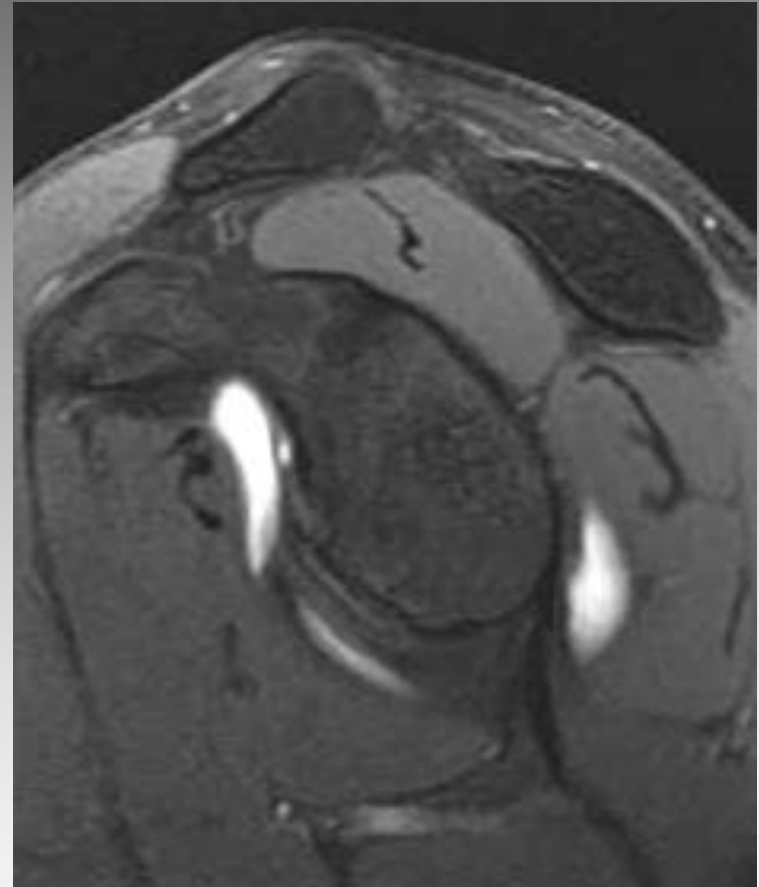


Coronal STIR Images

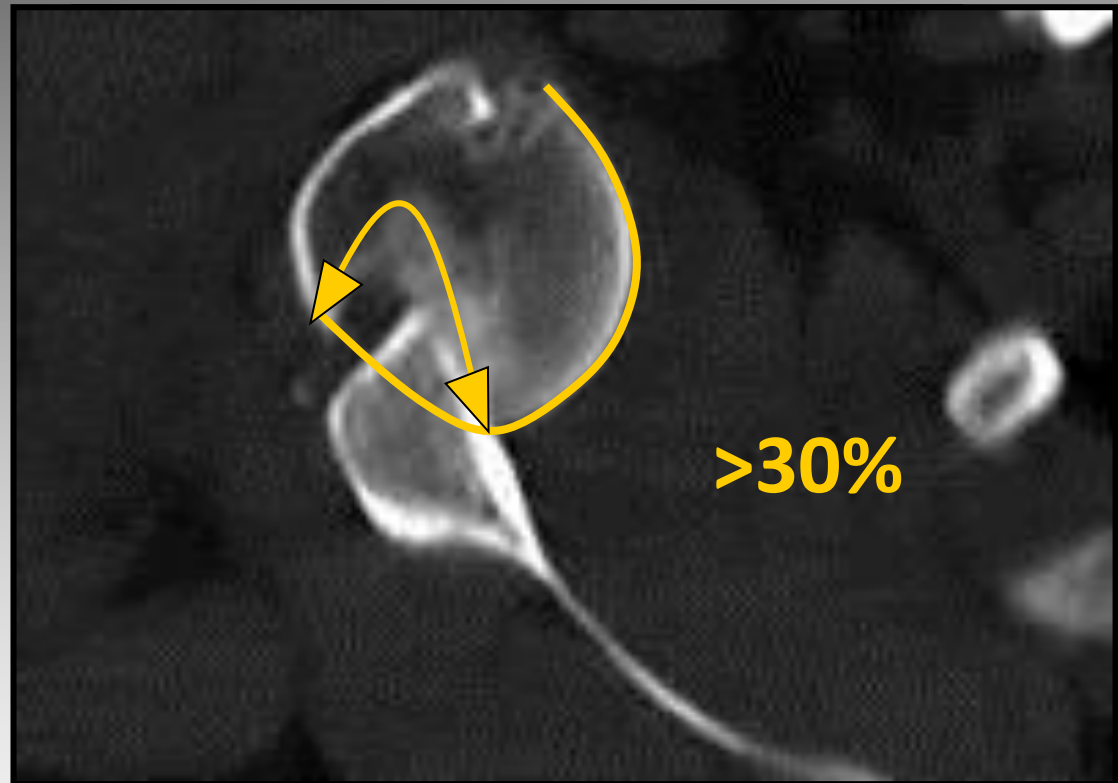
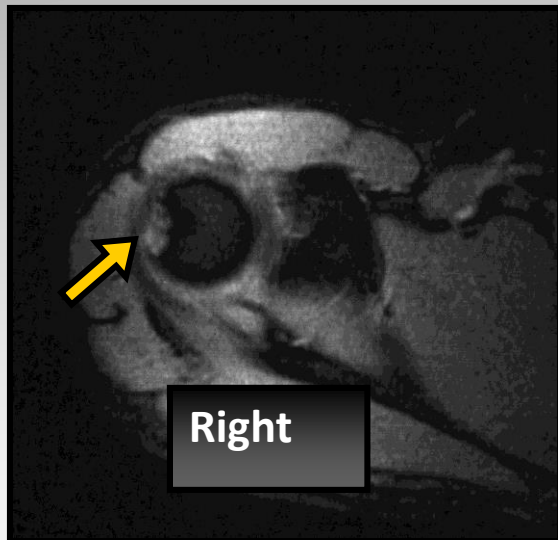
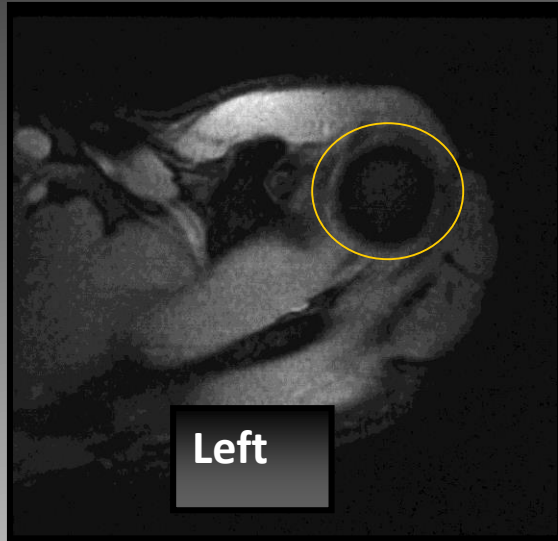


What Surgical Lesions Alter Management?

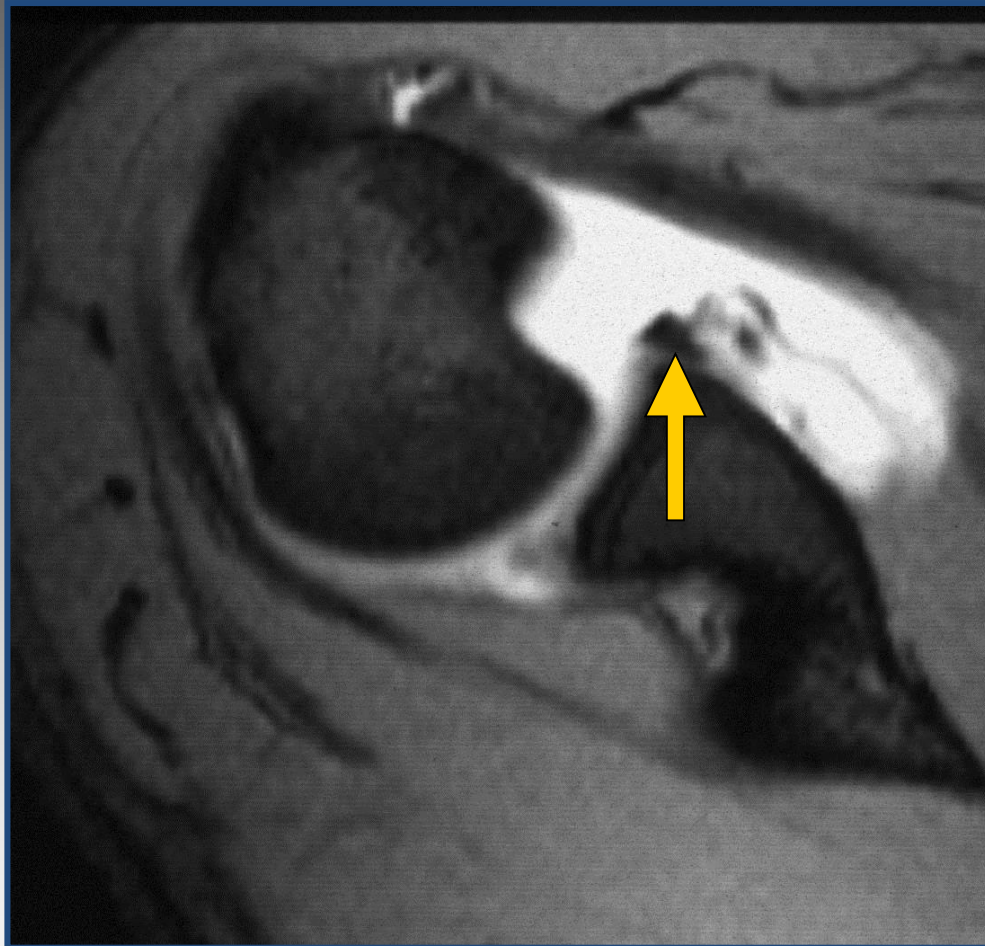
- Hill-Sachs lesion
 - Size
 - location
- Glenoid (Bony Bankart)
 - Size
 - attachments
- Labrum
 - Varied tears
 - Circumferential
- Humeral avulsion GHL (HAGL)



Hill-Sachs Lesion



Reversed Hill-Sach's Lesion and Multi-directional Instability

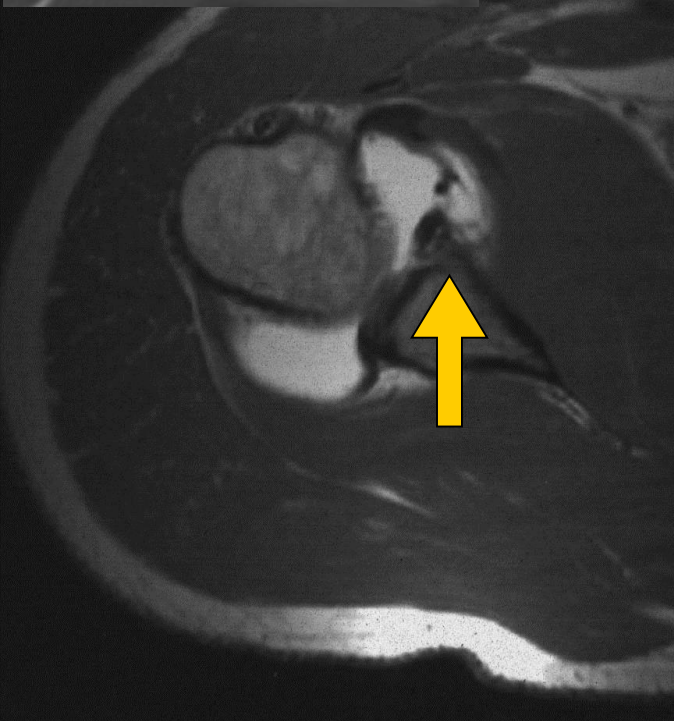
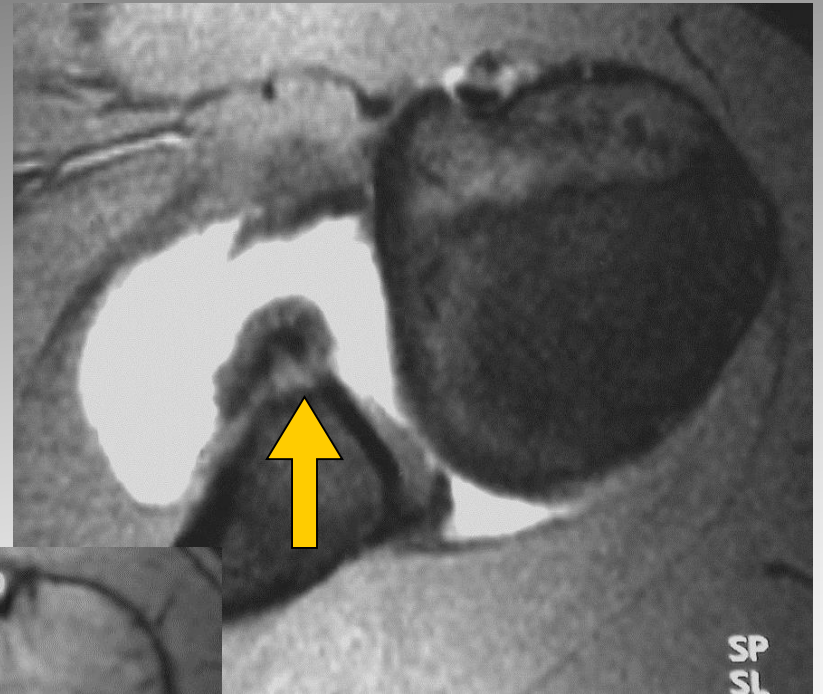


Bony Bankart Lesion

Smaller lesions: Sutured with labrum

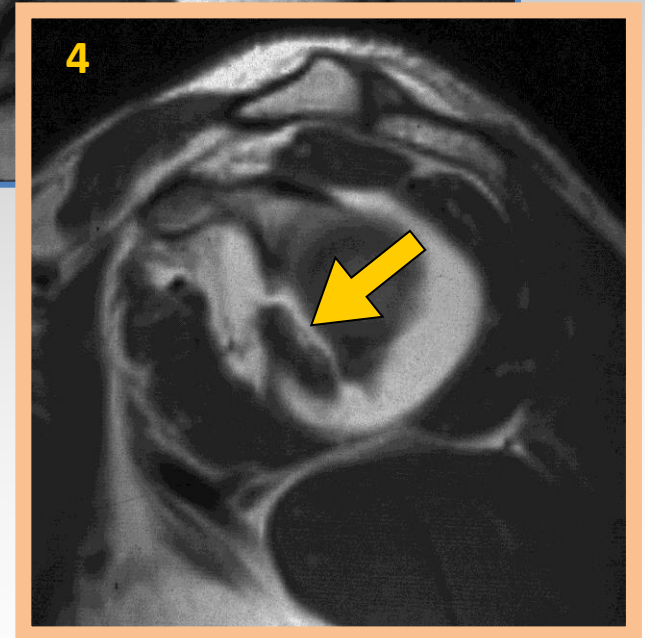
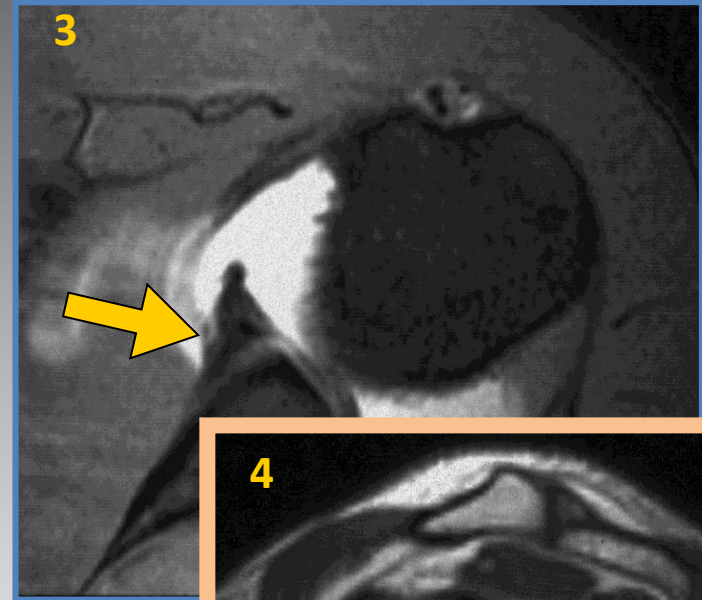
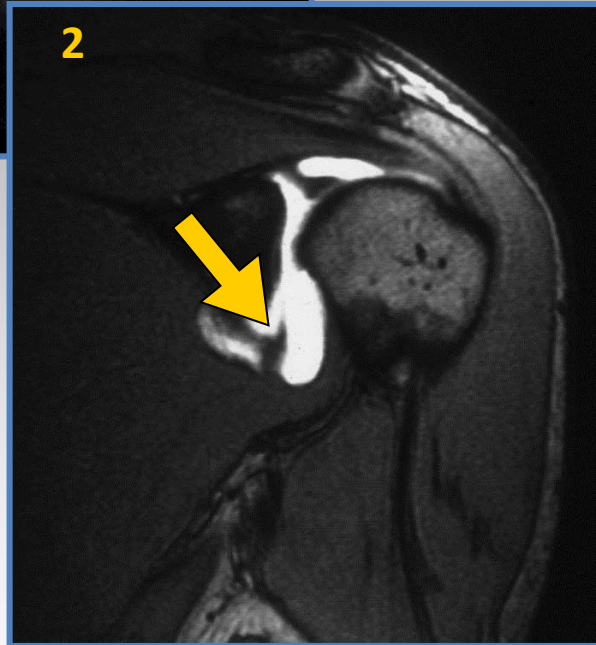
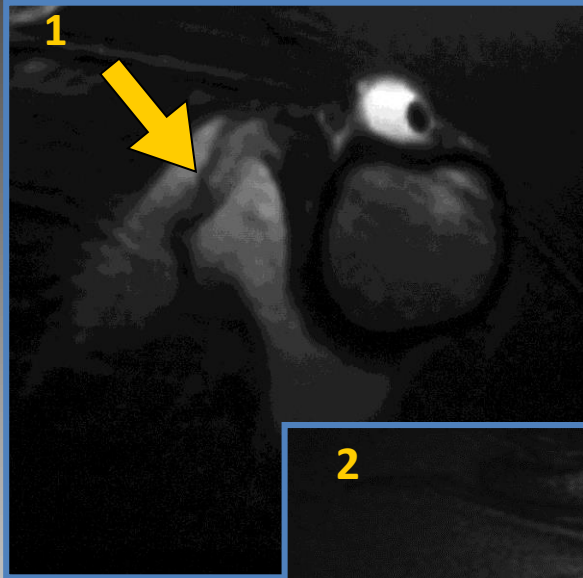
Larger lesions: Open reduction

Malunions: Liberated



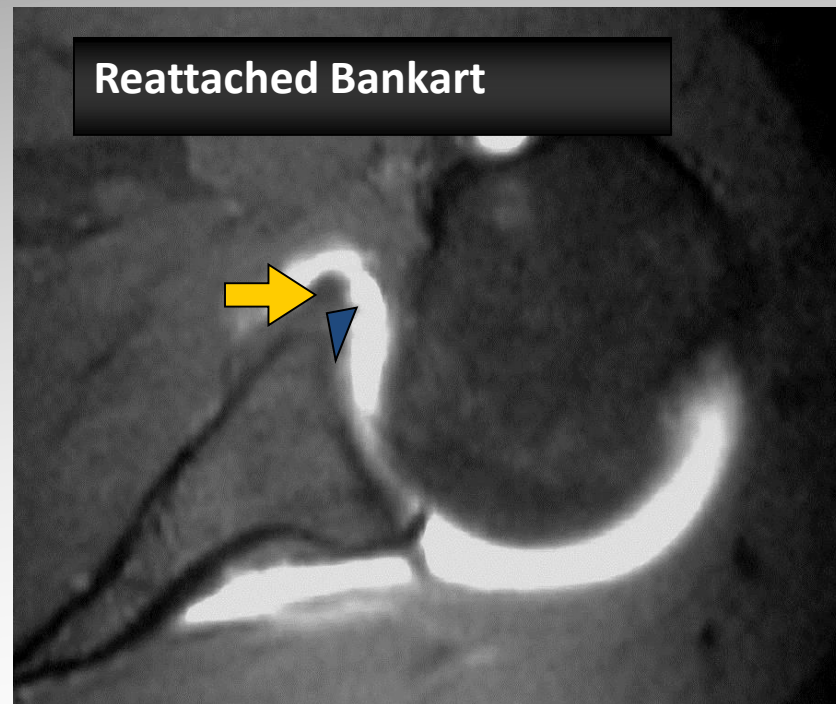
Glenohumeral Ligaments

Impact of Bony Bankart Lesion



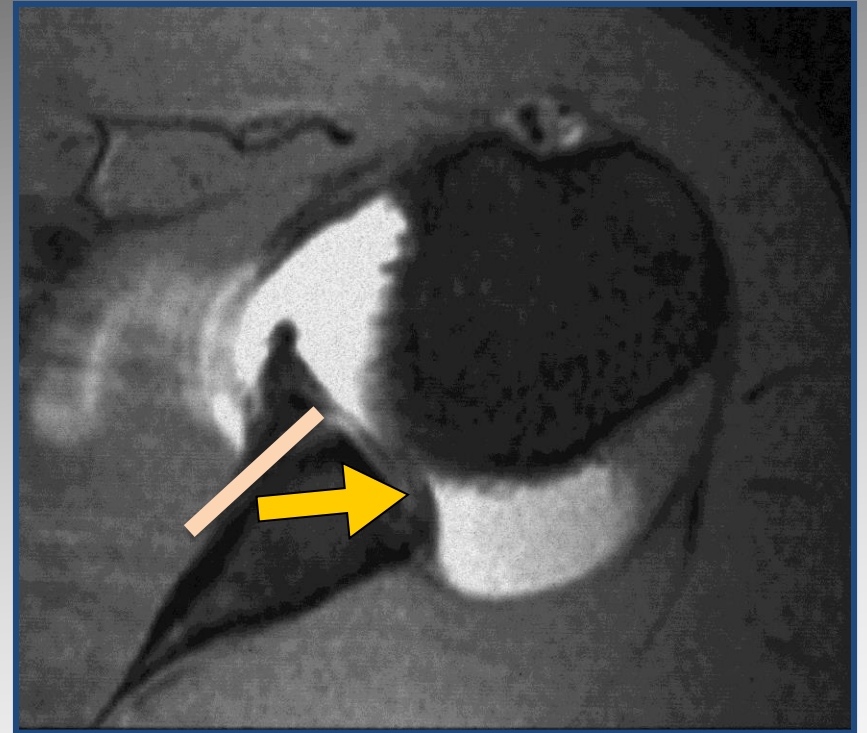
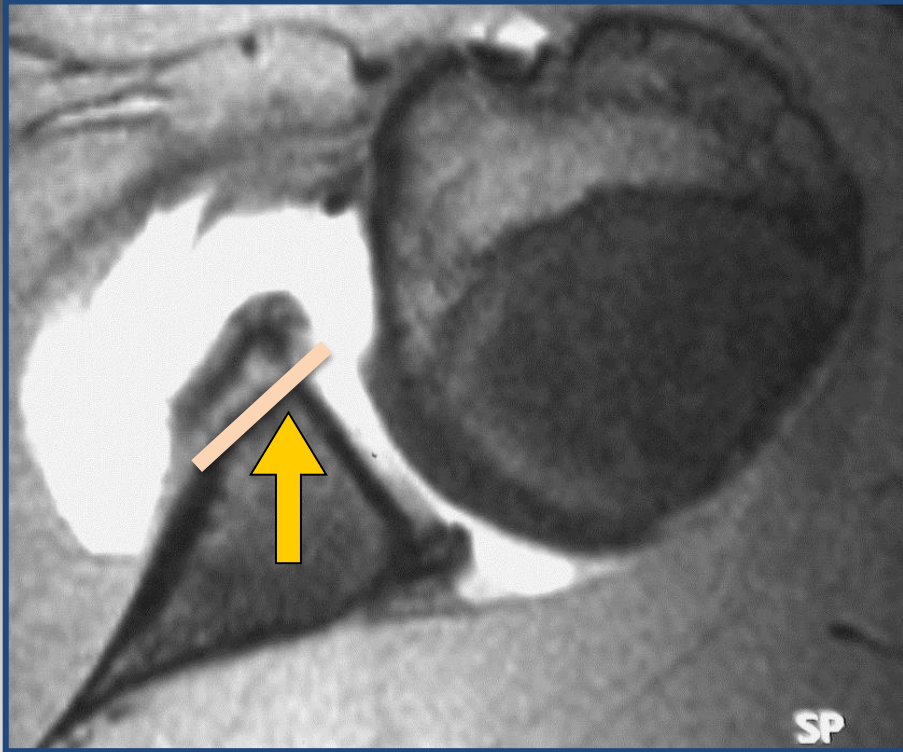
Labral Tear

Bankart lesion

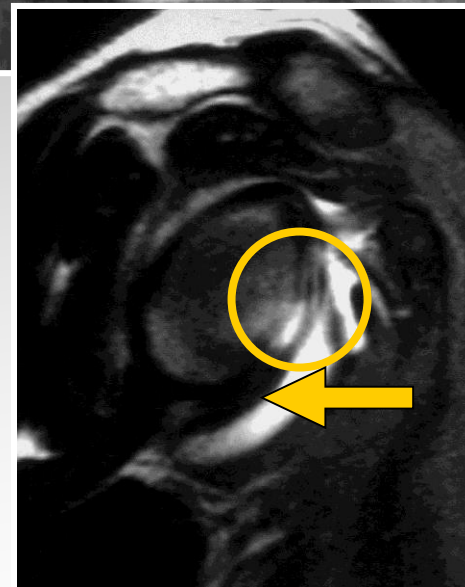
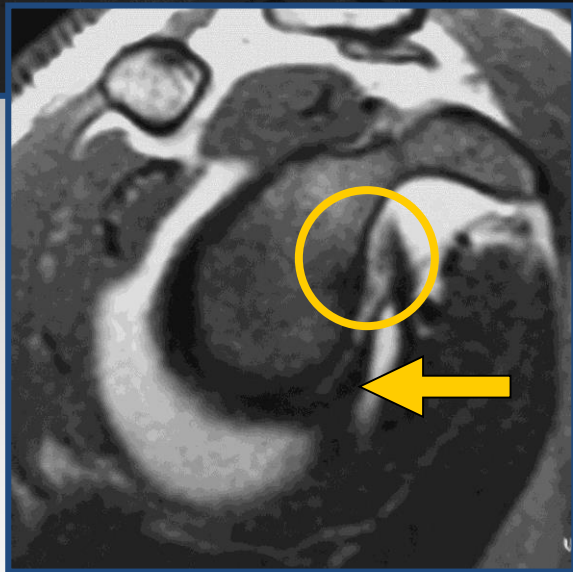
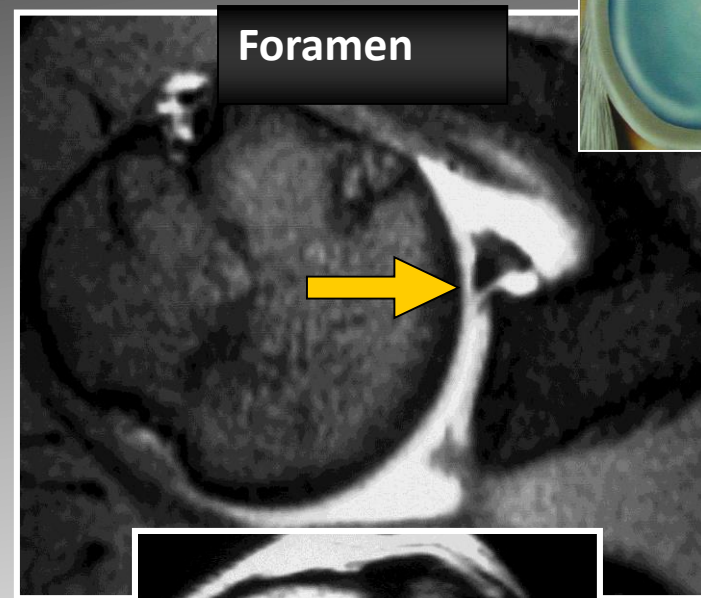
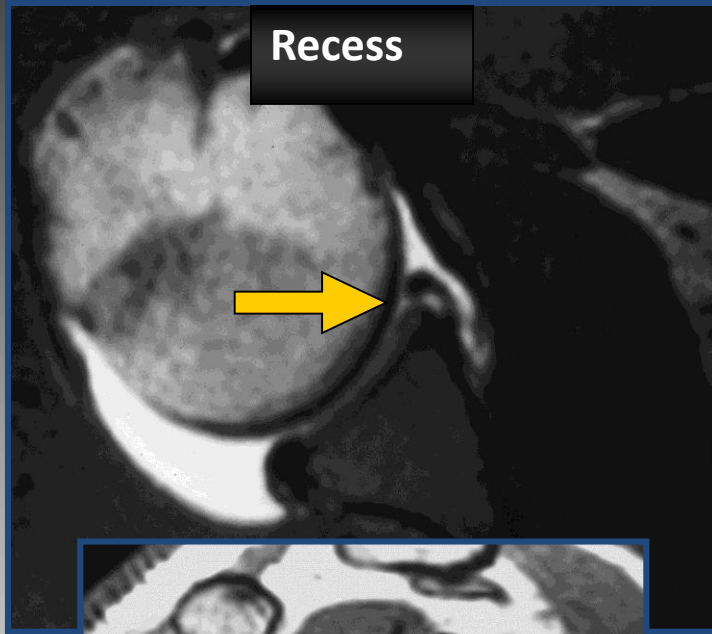
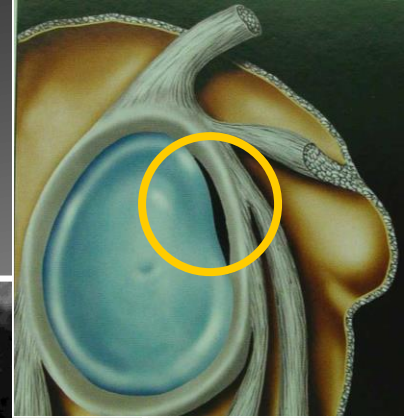


ALPSA: Chronic

Anterior labral and periosteal sleeve avulsion

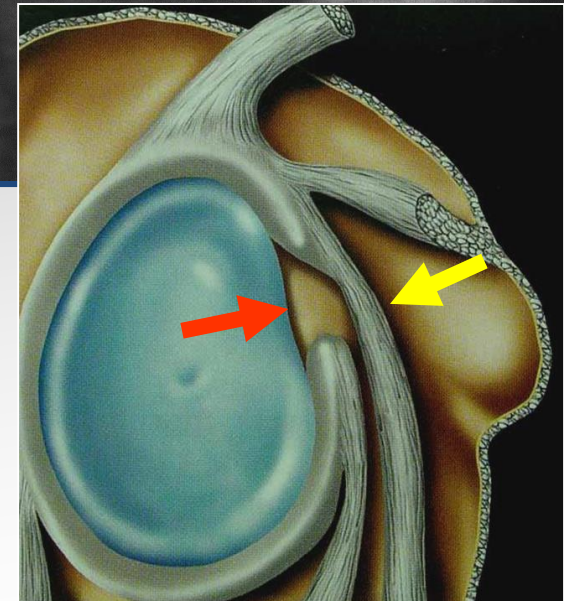
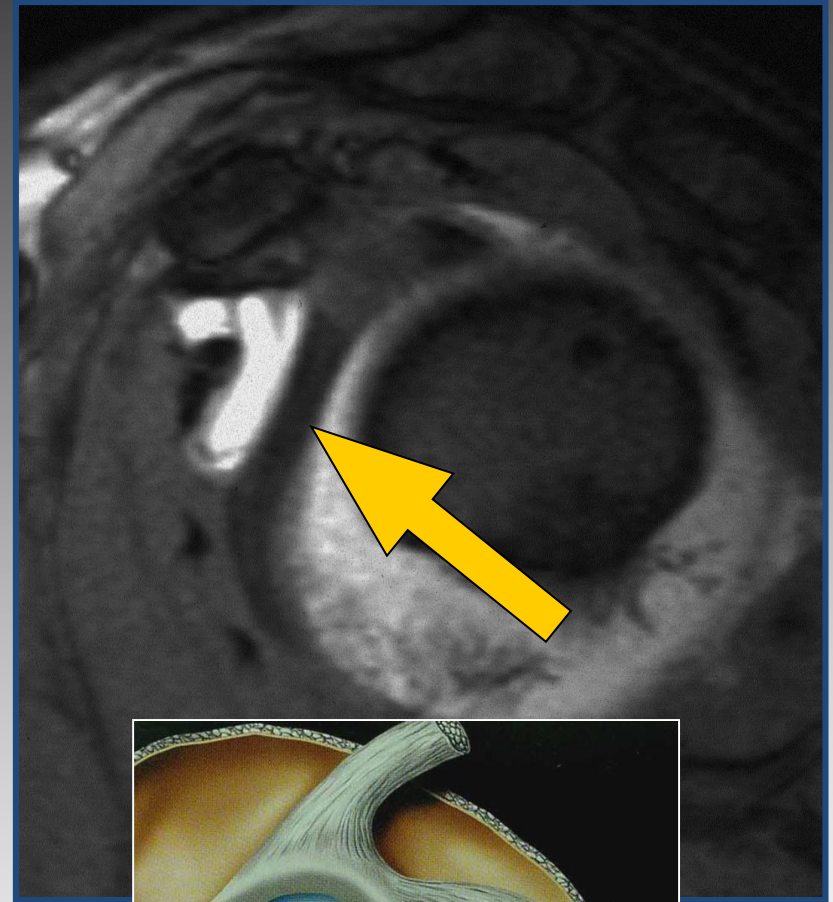
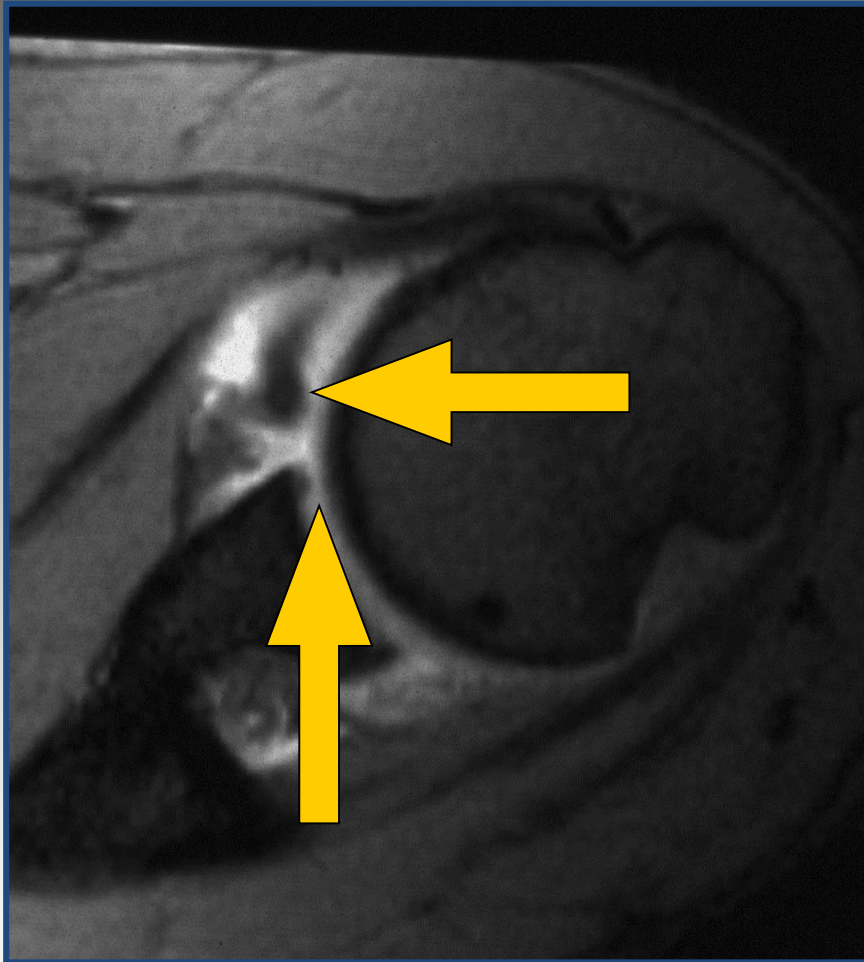


Sublabral Recess/Foramen

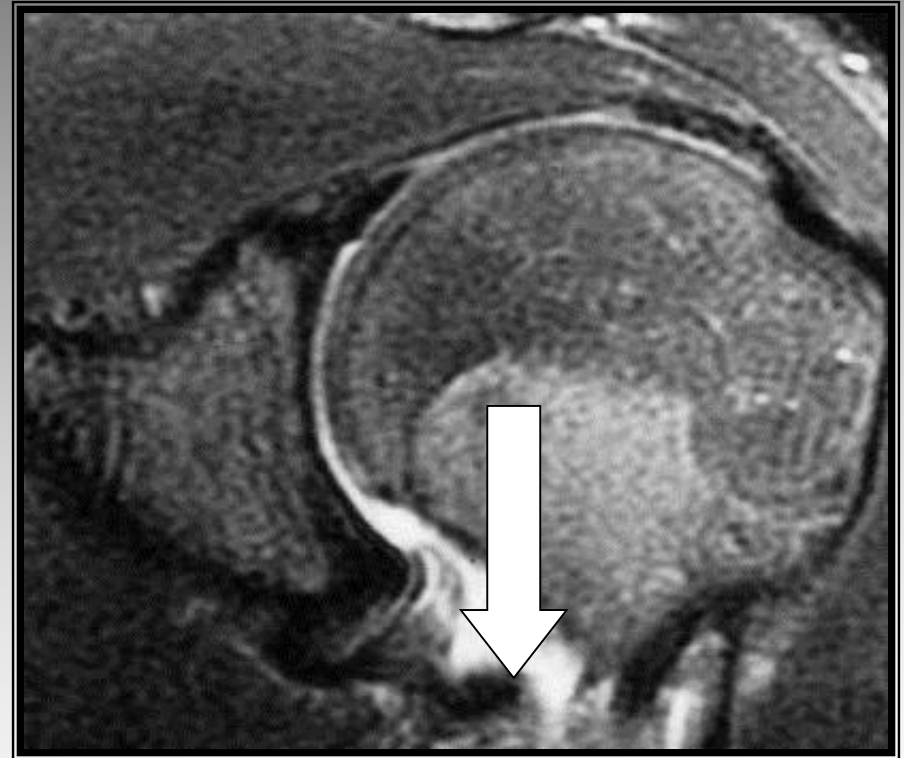
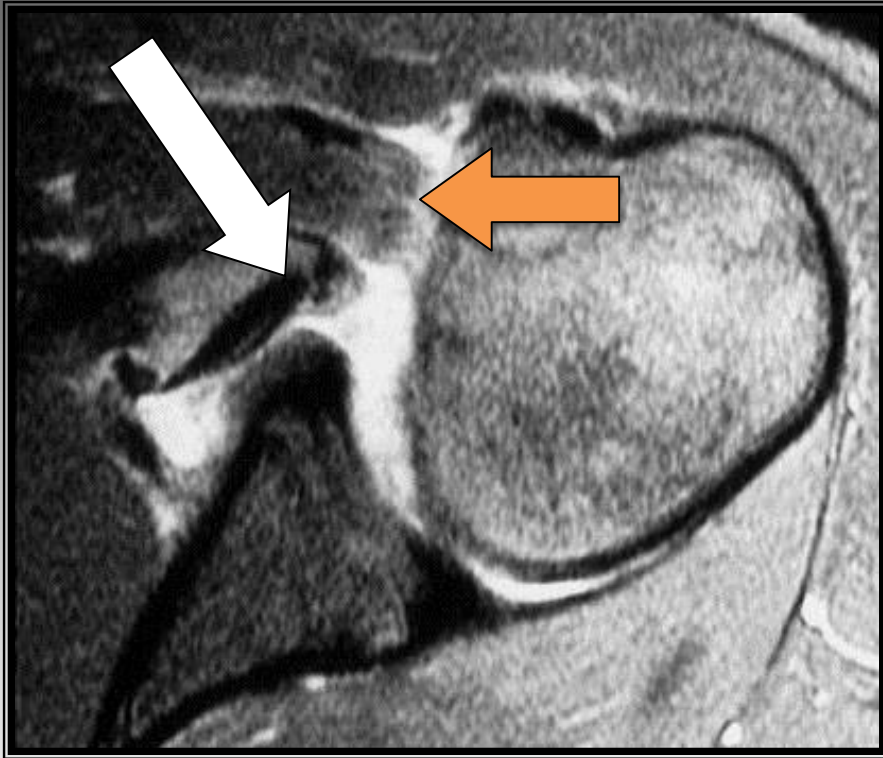


Buford Complex

Normal variant
Differential: Bankart Lesion



Humeral Avulsion of Glenohumeral Ligament (HAGL)





Case 4: 39 year old male patient presented to Orthopaedic Surgeon with intermittent pain

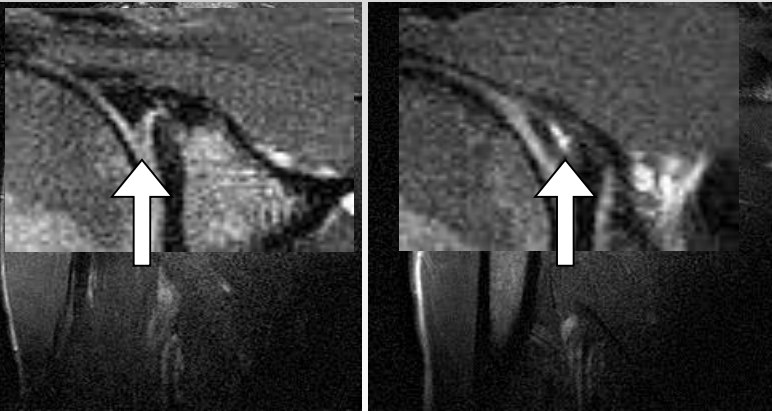
- Fallen onto an outstretched arm
- Pain with resistance
- Pain on abduction
- Intermittent catching

Coronal STIR Images



Identify the correct diagnosis?

- A. Infraspinatus tear
- B. Metaphyseal marrow infiltrate
- C. Oedema in posterior deltoid
- D. SLAP lesion**
- E. Avascular necrosis



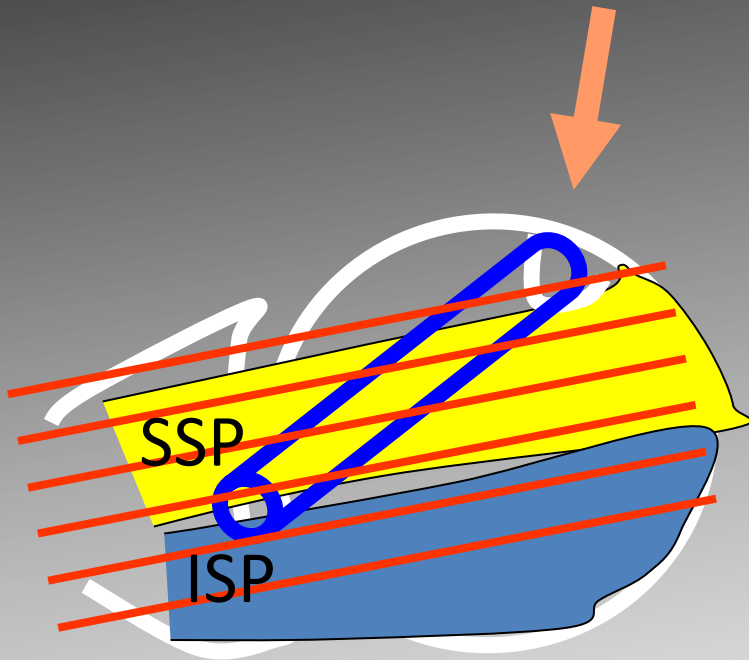
SLAP lesions

Superior Labral Anterior to Posterior Tear

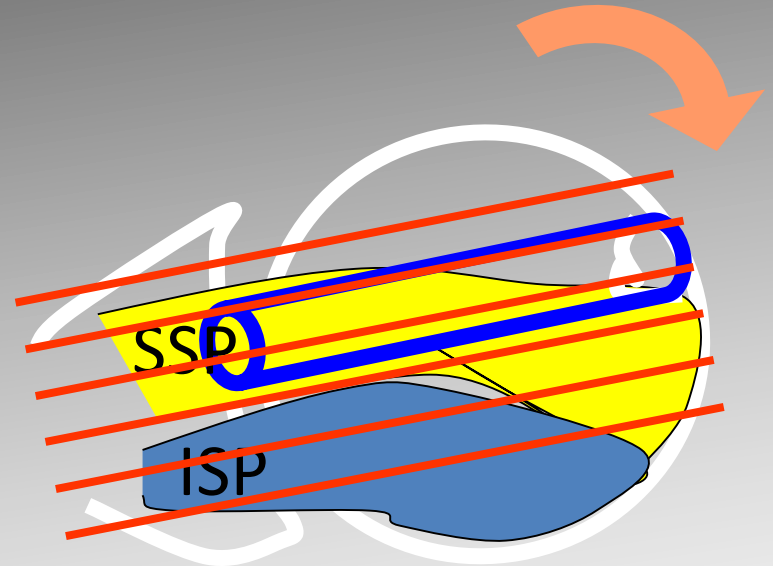
- Mechanism
 - Throwing
 - Falling-Dislocation
- Clinical Evaluation
- Anatomy
- Technique MR v MRA



MRArthrography



Neutral position



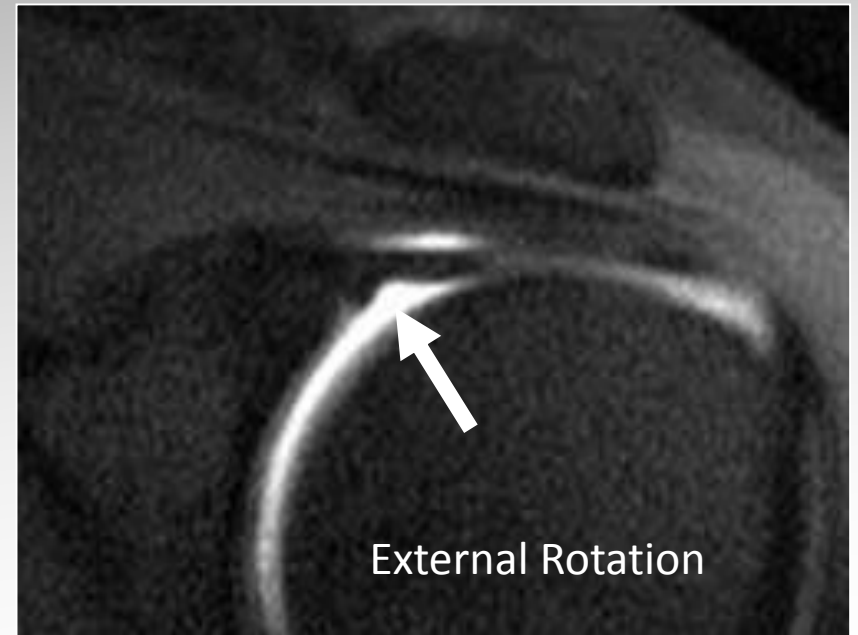
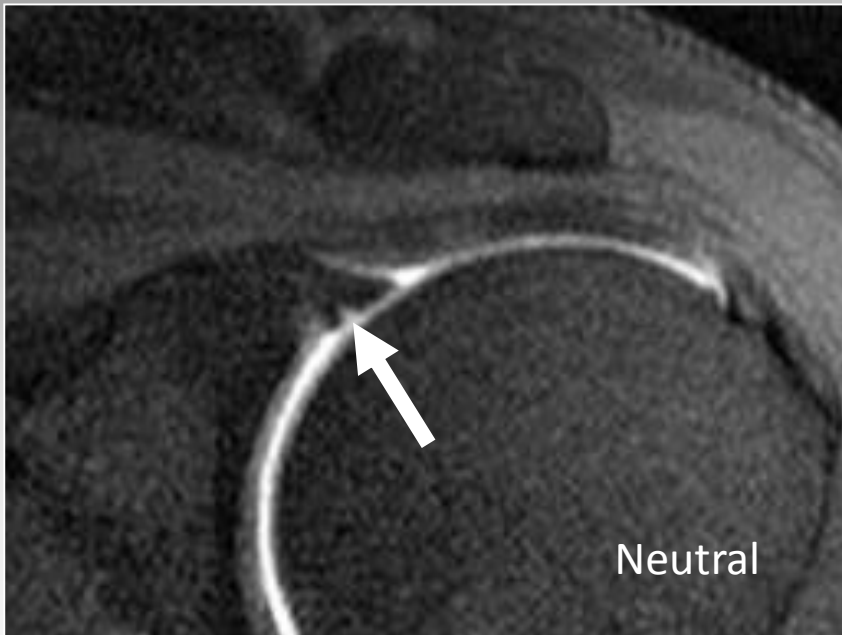
External rotation

MRA technique

Chan. SLAP lesions:
MRA with arm traction
AJR 1999; 173: 1117

- Cor Obl T1W fat sat
- Cor Obl STIR
- Sag Obl T1W fat sat
- Axial Obl T1W fat sat

Add Cor Obl T1W fat sat in external rotation



SLAP lesions – MRI v MRA

%	Sensitivity	Specificity	Accuracy
MRI	41 - 91	75 - 89	63 - 98
MRA	82 - 89	78 - 90	82 - 90

Connell. Am J Sports Med 1999

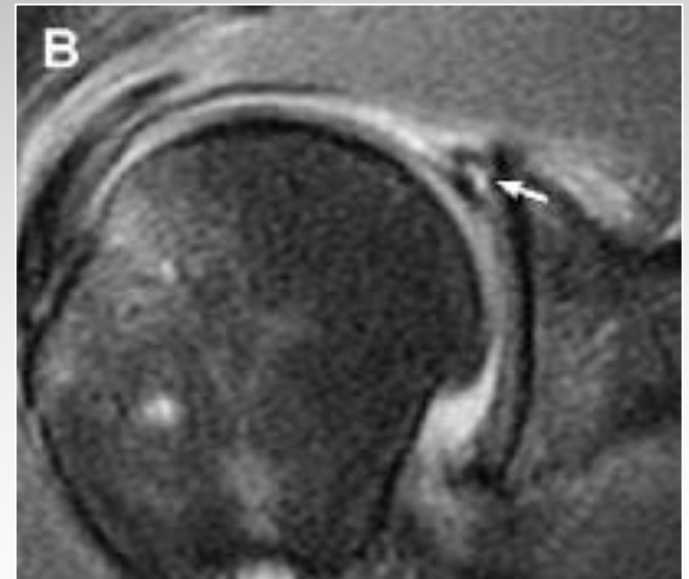
Yoneda. J Shoulder Elbow Surg 1998

Bencardino. Radiology 2000

Jee. Radiology 2001

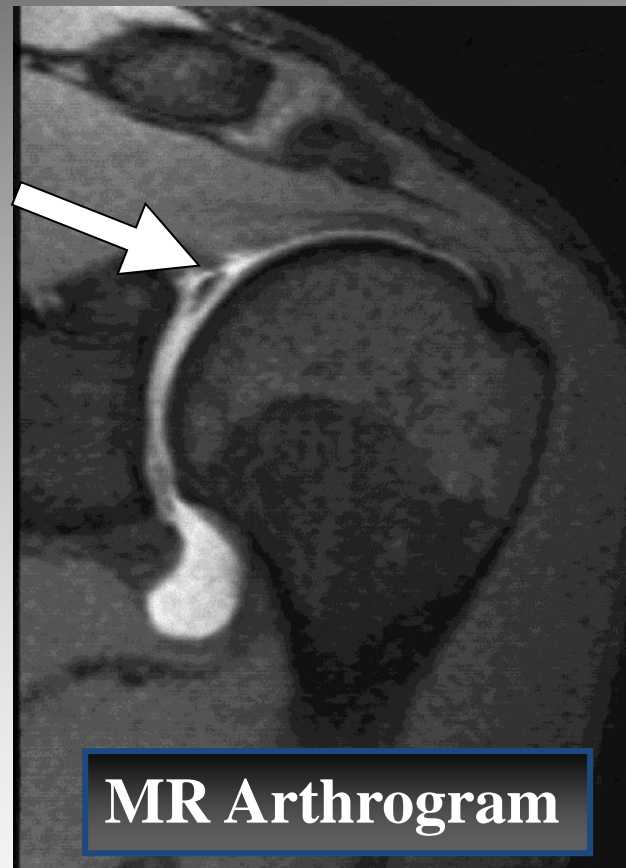
Waldt. AJR 2004

Reuss. J Shoulder Elbow Surg 2006



SLAP Lesion

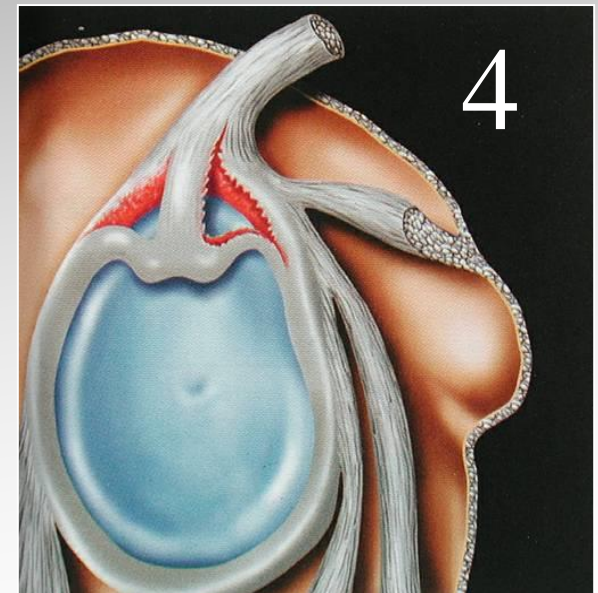
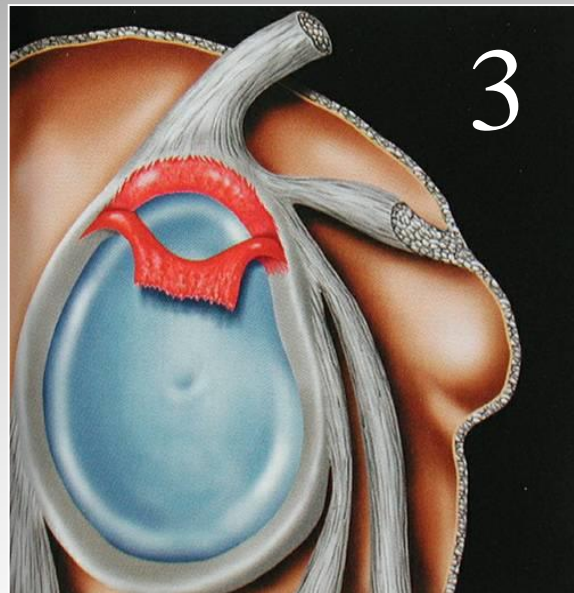
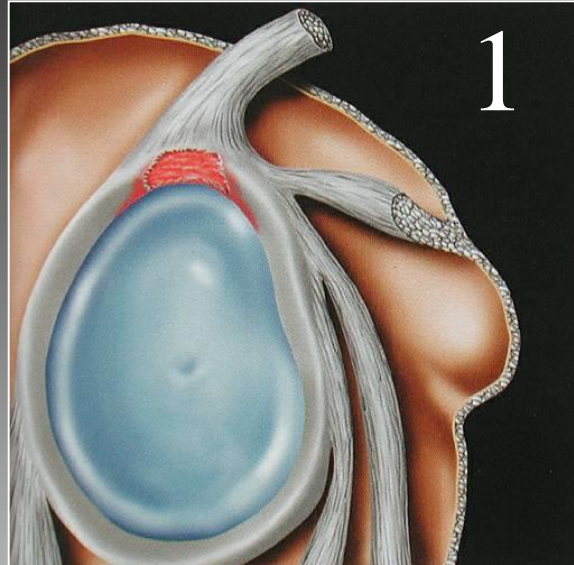
SLAP Type 3 Lesion



Monu et al, AJR, 1994; 163: 1425-1429

SLAP tears

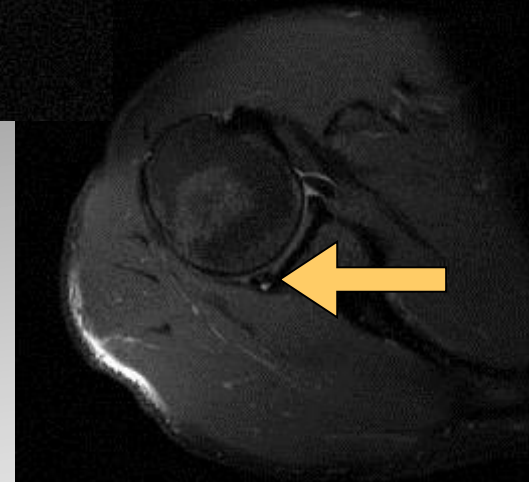
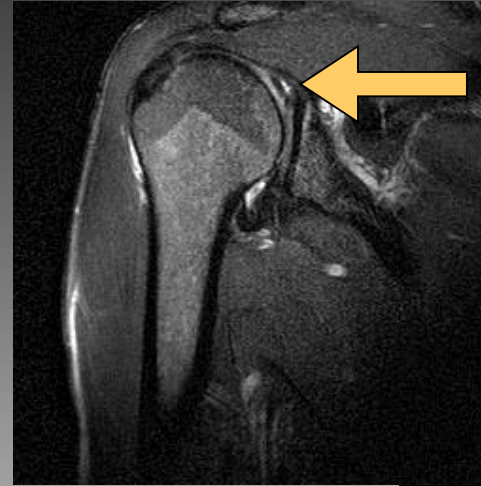
Superior Labral
Anterior to
Posterior Tear



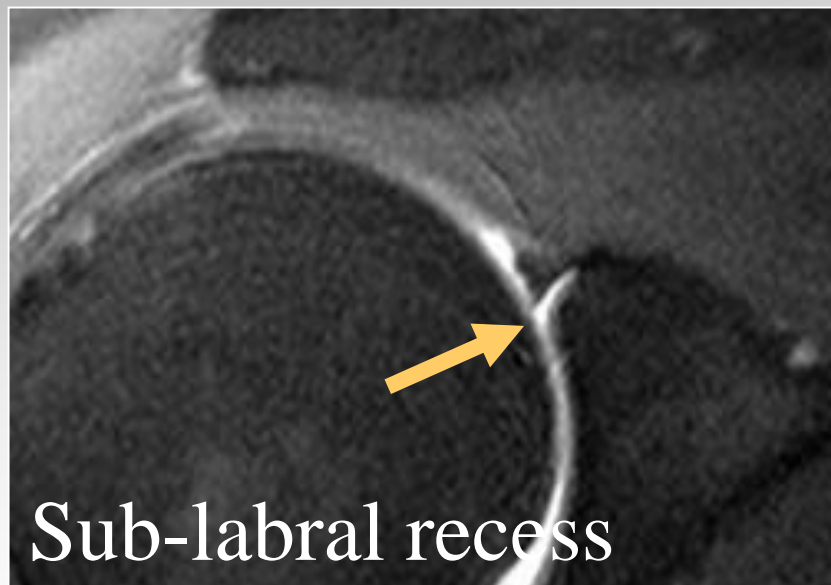
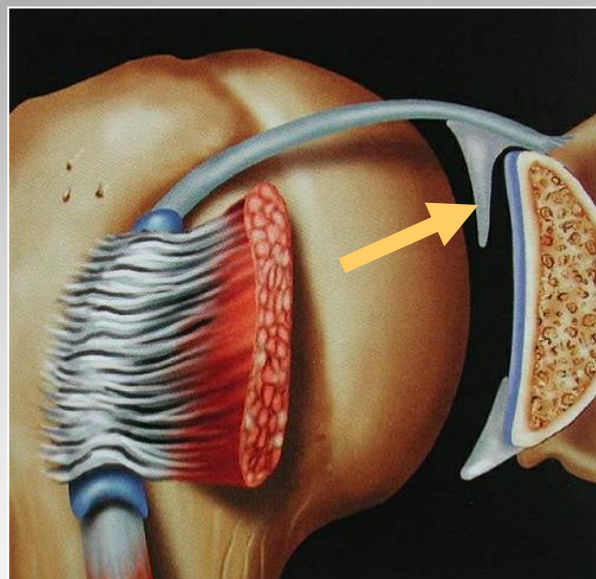
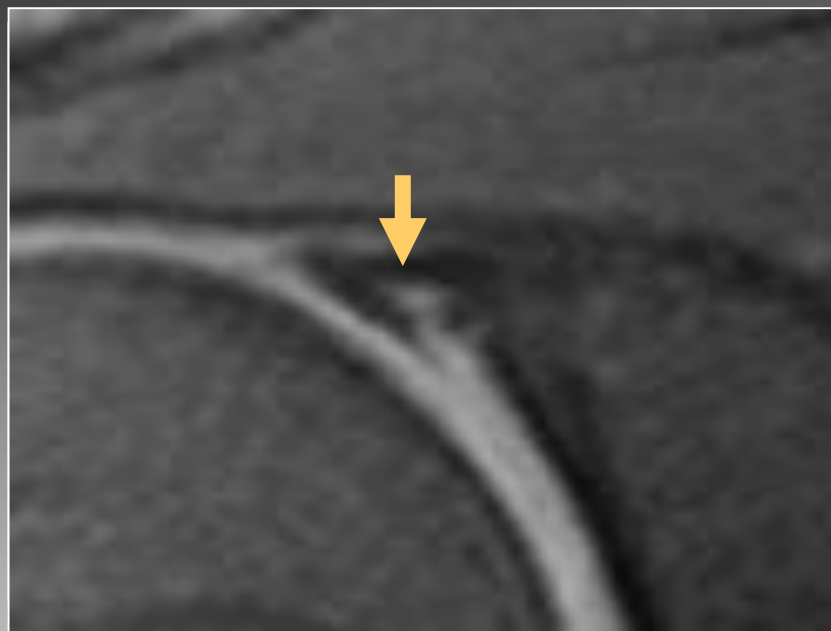
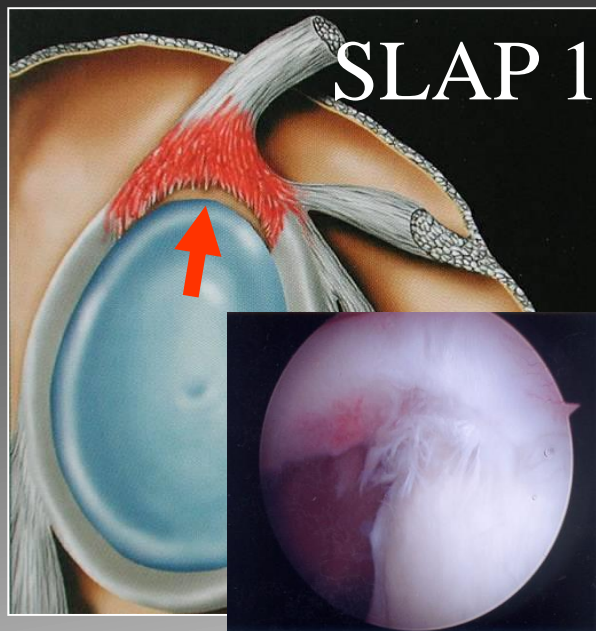
Snyder.
SLAP lesions
Arthroscopy
1990; 6: 274

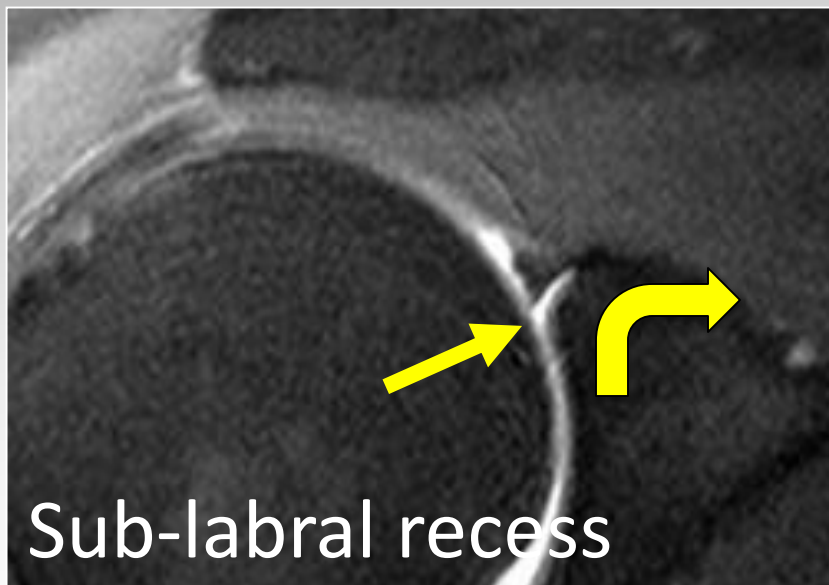
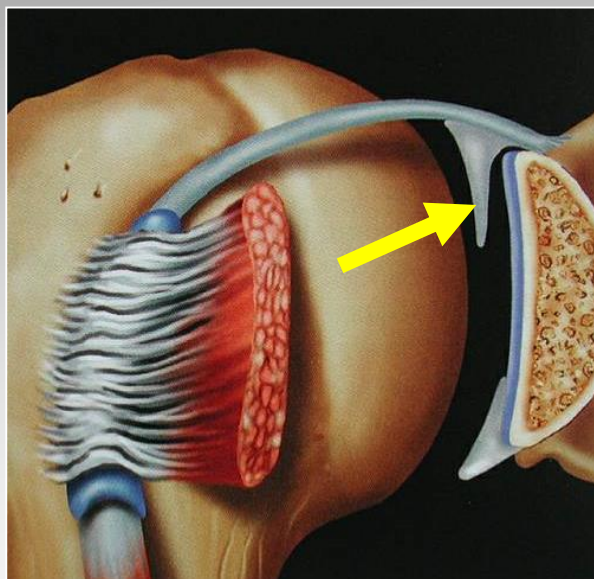
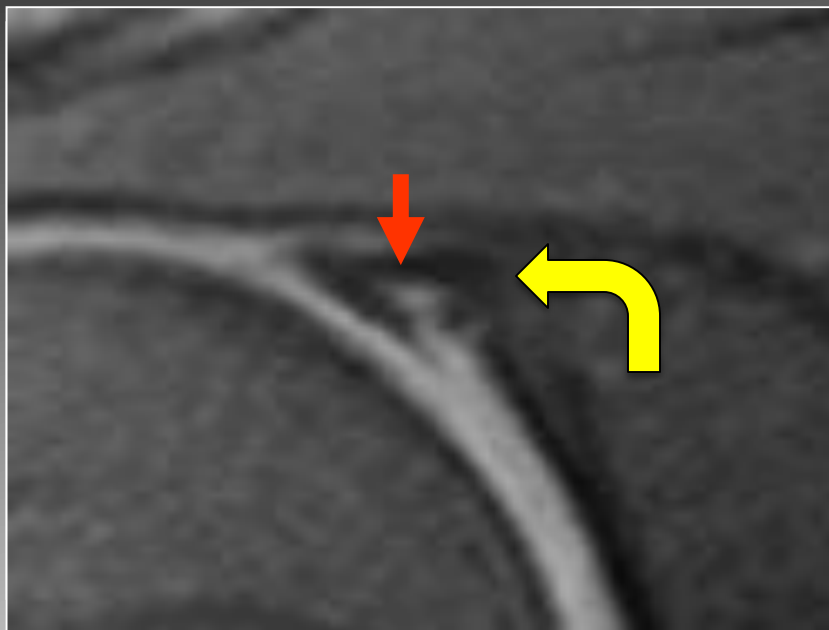
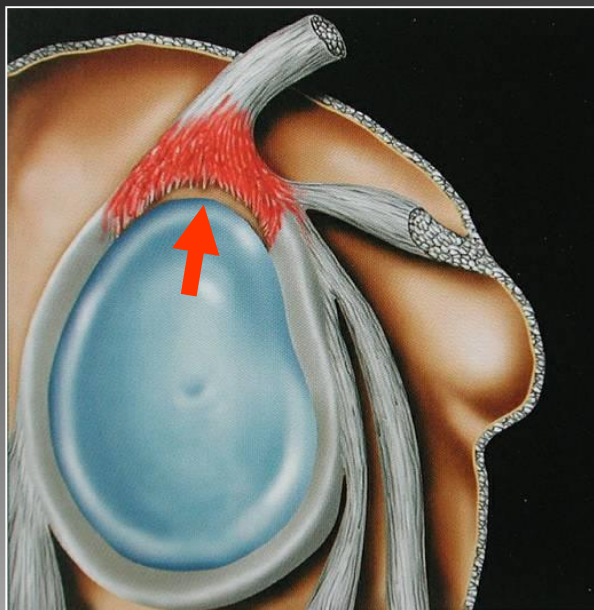
Extended SLAPS

- 6 – SLAP 3 with flap tear
- 5 – SLAP + anterior extension
- 8 – SLAP + posterior extension
- 9 – SLAP + anterior / posterior extension
- 7 – SLAP + tear of middle glenohumeral ligament
- 10 – SLAP + rotator cuff interval tear



Mohana-Borges SLAP tear: classification and diagnosis
AJR 2003;181:1449-62.

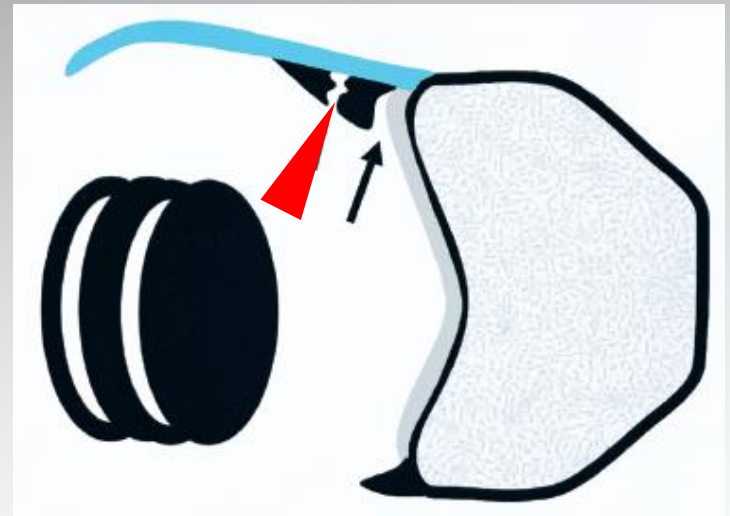
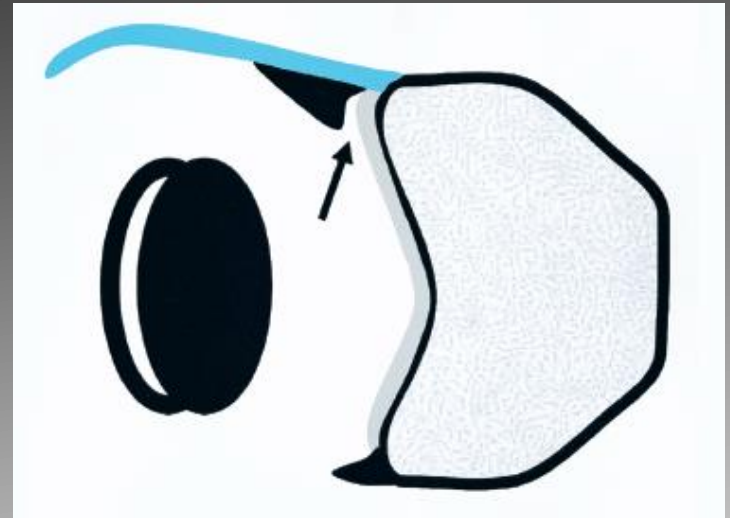
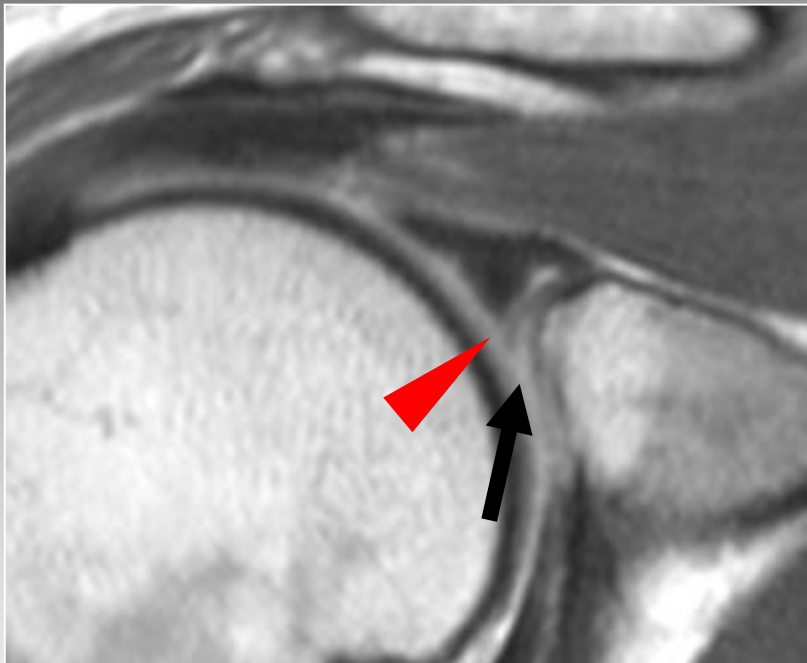




Sub-labral recess

Other MR signs

“Double Oreo” sign



Tuite. SLAP lesions: 3 signs on MR. Radiology 2000

Recommendations for MRI

- Rotator cuff
 - Elite sportsmen
 - Atypical pain
 - Unresponsive to treatment
- Instability
 - No option (CT?)
 - MR Arthrogram
- SLAP
 - MR Arthrogram

